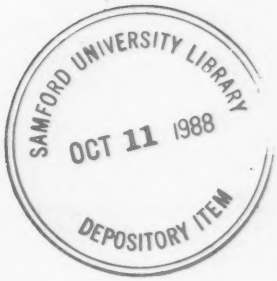
:13/19
PERIODICALS

Vol. 13, No. 19
October 15, 1988

Energy Research Abstracts

Abstracts 44545-46219



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ENERGY RESEARCH ABSTRACTS

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88-00415

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. **The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

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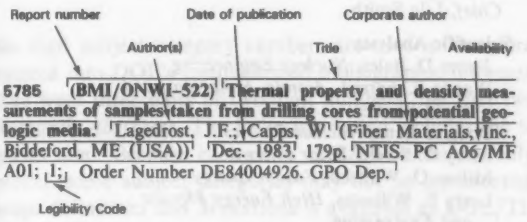
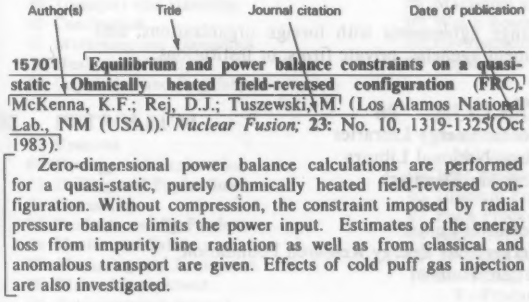
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; Order Number DE84004926. GPO Dep.
Legibility Code
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

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Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI–522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI–522	9:5785	NTIS, PC A09/MF A01. Order Number DE84004926, Distribution Category MN-70

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IEA Biomass Conversion Service
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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

44545 (NEDOJ—8703) Proceedings of parallel sessions for the 7th NEDO general assembly. (New Energy Development Organization, Tokyo (Japan)). 22 Sep 1987. 548p. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

This proceedings includes 16 papers. Coal conversion;4, Solar technology;6, Geothermal energy:5; Fuel cell and Energy storage:5, Alcohol and biomass:6, Coal resources:4

0103 Preparation

REFER ALSO TO CITATION(S) 44557, 44598

44546 (DOE/FE—0107) Clean Coal Technology Demonstration Program: Annual report to Congress. (USDOE Assistant Secretary for Fossil Energy, Washington, DC). 31 Dec 1987. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88012672/JAW.

The Clean Coal Technology Demonstration Program is a technology development program jointly funded by Government and industry. It will take the best and most promising of the advanced coal-based processing and emissions control technologies and over the next decade move them from the proof-of-concept stage into the commercial marketplace through demonstration. These demonstrations will be at a scale large enough to generate all data (from design, construction, and operation) necessary for the private sector to judge their commercial potential and to make informed commercial decisions. In this manner, the program serves as a bridge between research and development and the marketplace. The majority of the innovative clean coal technologies in this program are generally grouped into one of three categories: (1) retrofit technologies that can be used on existing plants to reduce emissions, (2) repowering technologies that replace a significant portion of the original plant and increase the power output of the facility, and (3) conversion technologies that have applicability in the industrial, commercial, transportation, and residential markets by utilizing coal conversion processes that produce liquid and gaseous fuels.

44547 (EUR—11400) Substitution of oil by pulverized coal in small industrial boilers: Demonstration project: Final report. (Commission of the European Communities, Luxembourg). 1988. 29p. (In French). NTIS (US Sales Only), PC A03. Order Number DE88012637/JAW.

The aim of the project was to show the advantages, even for installations of relatively small capacity (a few MW), of substituting oil by pulverized coal with handling, operation and automation at levels of convenience simi-similar to those available for liquid fuels. To this end, a 6 MW boiler was installed at the Winterslag mine. The problem was to ensure efficient combustion in a small furnace at relatively low temperatures. The water tube boiler was equipped with two roof burners, an economizer and a bag filter. Particular attention was paid to the control system. During commissioning, problems of flame stabilisation were encountered; stabilisation could not be achieved by the normal method of altering the velocity and turbulence of the combustion air in the burner, but the problem was solved by distributing the air over the length of the flame. In addition, self-ignition of the pulverized coal occurred as a result of air leakage at the bottom of the storage silo. To overcome the high level of the unburnt carbon, finer pulverized coal was used. Once these problems had been overcome, the original objectives were largely achieved: the boiler lit up automatically and operated flexibly between 15 and 100% of its rating, and no dust problems were encountered in the handling of coal and ash. 10 figs.

0104 Processing

REFER ALSO TO CITATION(S) 44546, 44597, 44601, 44604, 44863, 44864, 44935, 45227, 45410

44548 (BNL—41050) Mild gasification of coal: First quarterly technical progress report for the period October 1-December 31, 1987. Sundaram, M.S.; Fallon, P.T.; Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). Jan 1988. Contract AC02-76CH00016. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88011097/JAW.

The entrained down-flow tubular reactor systems was modified for gasification of coal under mild reaction conditions. A data matrix was developed based on statistical considerations to investigate the effects of (1) coal rank, (2) reaction temperature, (3) coal heat-up rate, and (4) coal particle residence time at temperature, (5) lime additive and (6) entraining gas pressure, on the production of liquid and gaseous hydrocarbons. Three different coals, were initially investigated. The Brookhaven National Laboratory (BNL) tubular moving-bed reactor was used to perform a total of 12 experimental runs at two levels of the process variables, temperature 550{degree} and 650{degree}C, pressure 15 and 30 psi, coal particles residence time of 0.1 min. and 2 min., and lime additive 0% and 10% of the coal fed, with inert N_2 as the sweep gas. Results and experimental data are presented. 14 figs., 8 tabs.

44549 (CRIE-W—87015) Collection efficiency of counter flow type electrostatic granular bed (EGB) filter(Part 1). Makino, Hisao; Nagayama, Tsutomu; Watanabe, Masatoshi; Ito, Shigeo; Tanaka, Takashi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Oct 1987. 31p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753875/JAW.

The counter flow type Electrostatic Granular bed filter was developed as a dry type dust collector of coal gasification combined cycle. This report describes on the experimental result at ambient pressure. (1) Char particles formed by coal gasification has very low electric resistivity. In the case of continuous operation with a fixed bed, application of voltage gets difficult in short time. (2) When the EGB is operated at counter flow type moving bed, voltage application time increases with the increase of moving velocity. At the char concentration below 5 g/m^3 and the filtration velocity below 35 cm/sec, a filler transfer velocity which enables the continuous operation at all conditions was found. (3) Collection efficiency of EGB is much higher than the collection efficiency of granular bed filter, and the concentration of the char of about 1 micron size which is most difficult to be collected decreased down to 1/20 at the outlet. (28 figs, 2 tabs, 7 refs)

44550 (DOE/ER/13814—1) Direct alcohol synthesis using modified cobalt catalysts: A progress report. Griffin, G.L. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemical Engineering). 22 Mar 1988. Contract FG05-87ER13814. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014120/JAW.

We describe the preparation, characterization, and kinetic activity measurements of a sequence of Cu : ZnO and Cu : Co : ZnO : Al_2O_3 catalysts for alcohol synthesis via CO hydrogenation. For binary Cu : ZnO catalysts prepared by various precipitation methods, methanol is the only reaction product and its rate for formation is proportional to the metallic Cu surface area of the catalysts. For Cu : Co : ZnO : Al_2O_3 : K catalysts, a Schulz-Flory-Anderson distribution of higher alcohols forms the major product group, with smaller amounts of hydrocarbons and methanol being formed in parallel. The overall yield of higher alcohols increases

linearly with CO conversion, while the selectivity for hydrocarbon products increases slightly with conversion. The product alcohols do not undergo a significantly degree of secondary reaction at the concentrations formed under these conditions. Temperature programmed desorption experiments using both H_2 and CO reveals the presence of distinguishable Cu and Co adsorption sites, with some limited evidence for interaction between sites. The overall results are consistent with a mechanism for higher alcohol synthesis that involves chain growth of a common surface alkyl intermediate at a surface-modified Co site, followed by a chain termination step which determines whether the final product desorbs as an alcohol or hydrocarbon. 26 refs.

44551 (DOE/FE/55014—T30) Great Plains Coal Gasification Project: Quarterly technical progress report, third fiscal quarter 1987-1988, January-March 1988. (ANG Coal Gasification Co., Beulah, ND (USA)). 31 May 1988. Contract FM02-82FE55014. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013936/JAW.

This progress report describes the operation of the Great Plains Gasification Plant, including lignite coal production, SNG production, gas quality, by-products, and certain problems encountered. (LTN)

44552 (DOE/FE/55014—T31) [Great Plains Coal Gasification Project]: Quarterly environmental, safety, and medical report, first quarter 1988. (ANG Coal Gasification Co., Beulah, ND (USA)). May 1988. Contract FM02-82FE55014. 233p. NTIS, PC A11. Order Number DE88013937/JAW.

The following brief synopsis is provided of the status of Environmental, Safety and Medical Programs described in the First Quarter 1988 Report. Tabular summaries of environmental QA/QC results and planned next quarter activities are presented in Sections 2.0 and 3.0, respectively. ANG continued permitting activity during the reporting period. These activities include reviewing the revised RCRA Part B application; receiving approval to discharge high temperature, low pressure steam condensate to the stormwater system; receiving approval to expand the current gasifier ash pit; submitting the results of the EPA laboratory audit samples; finalizing the contract for the Deepwell No. 1 and No. 2 work to comply with UIC-101; monitoring the progress of the cooling tower surge pond B liner leaks; receiving approval to delete several parameters in the Interim Groundwater Monitoring Plan; responding to an EPA Hazardous Waste Questionnaire and a CERCLA site assessment for DOE; submitting the DOE-assigned section for the Modified Permit Application; and submitting the first annual chemical inventory report to comply with Section 312 of SARA. ANG conducted eight monitoring programs in the vicinity of the Great Plains facility. The RAMP network consists of five monitoring sites, and it is designed to monitor meteorology and air quality in the vicinity of the Great Plains facility and the Antelope Valley and Coyote electric generating stations. ANG conducts ambient monitoring for H{sub 2}S at one site in the vicinity of the Great Plains facility. 15 figs., 49 tabs.

44553 (DOE/MC/21004—2605) Expansion of high-temperature, high-pressure data set for coal gasification: Final report. Serio, M.A.; Solomon, P.R.; Krou, E.; Deshpande, G.V. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). Oct 1987. Contract AC21-84MC21004. 141p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88010268/JAW.

Coal devolatilization is one of the most important factors in gasification and combustion processes. It encompasses the initial release of volatiles, sets the stage for subsequent secondary reactions of volatiles, and established the amount and reactivity of the remaining char. While extensive devolatilization measurements have been made at 1 atm pressure, most of the gasification processes of current interest will be carried out at elevated pressures (5-50 atm). The objectives of this program were to address the following scientific questions: How are the kinetic rates for coal pyrolysis affected by pressure? What are the relationships between the reactivity of char and its formation conditions (pressure, temperature, heating rate)? What is the effect of high pressure and/or high temperature on pyrolysis product yields? What is the effect of high pressure and/or high temperature gasification reactions in CO_2? The major accomplishments of the program included a series of baseline kinetic pyrolysis experiments at one atmosphere pressure with the Montana Rosebud coal, which included material balances, particle temperature measurements, and thermal and optical property measurements. The kinetic rates for overall mass loss were consistent with values determined for coals of lower, higher, and similar rank in our other programs. The rates are significantly higher than most values in the literature at temperature above 600{degree}C. In addition, pyrolysis data for the Montana Rosebud coal were obtained at pressures up to 400 psig. 65 refs., 59 figs., 31 tabs.

44554 (DOE/MC/23057—2604) Novel concept development of an internal recirculation catalyst for mild gasification: Progress report for the period December 1, 1987--February 29, 1988. Knight, R.A.; Solka, B.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1988. Contract AC21-86MC23057. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013126/JAW.

During this quarter, experimental work involving zinc chloride as a potential recirculating catalyst for coal, initiated in the previous quarter, was continued. All experiments were performed with Illinois No. 6 high-volatile bituminous coal. Seventeen pyrolysis-gas-chromatography experiments were performed with Illinois No. 6 coal in helium. Coal samples were tested without catalyst and with 19.1 weight percent zinc chloride. The data showed that the devolatilization weight loss was reduced from 43% to 30% by the presence of catalyst in this coal; this was in contrast to prior experiments with North Dakota lignite, in which case there was no significant difference in weight loss with and without the catalyst. Four devolatilization experiments at temperatures up to 837{degree}F in a thermogravimetric analyzer revealed that 10% $ZnCl_2$ increased the weight loss from coal. The devolatilization weight loss also was higher with methanol as the impregnating solvent rather than water, even when no catalyst was present. Four standard Fischer-Assay tests on catalyzed and uncatalyzed coal revealed no significant differences in yields or product distribution. A total of sixty-five devolatilization experiments in a combustion-tube-type apparatus were completed, covering a temperature range of 662{degree} to 1610{degree}F, and residence times of 1 to 3 minutes. Illinois coal {emdash} untreated, methanol-treated, water-treated, and catalyzed with $ZnCl_2$ from both water and methanol solutions-was tested in the apparatus, with helium and most CO_2 used as purging gases. The catalyst-free weight loss varied from 5.0 to 36.3%, and there was no identifiable effect from catalyst, solvent, or gas composition on the overall devolatilization weight loss. 1 fig., 6 tabs.

44555 (DOE/MC/23075—2596) Measurement and modeling of advanced coal conversion processes: Sixth quarterly report, January 1-March 31, 1988. Solomon, P.R.; Hamblen, D.G.; Serio, M.A.; Smoot, L.D.; Brewster, S. (Advanced Fuel Research, Inc., East Hartford, CT (USA); Brigham Young Univ., Provo, UT (USA)). Mar 1988. Contract AC21-86MC23075. 194p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88010256/JAW.

The overall objective of this program is the development of predictive capability for the design, scale up, simulation, control and feedstock evaluation in advanced coal conversion devices. This technology is important to reduce the technical and economic risks inherent in utilizing coal, a feedstock whose variable and often unexpected behavior presents a significant challenge. This program will merge significant advances made at Advanced Fuel Research, Inc. (AFR) in measuring and quantitatively describing the mechanisms in coal conversion behavior, with technology being developed at Brigham Young University (BYU) in comprehensive computer codes for mechanistic modeling of entrained-bed gasification. Additional capabilities in predicting pollutant formation will be implemented and the technology will be expanded to fixed-bed reactors. The foundation to describe coal-specific conversion behavior will be AFR's Functional Group (FG) and Devolatilization, Vaporization, and Crosslinking (DVC) models, developed under previous and on-going METC sponsored programs. These models have demonstrated the capability to describe the time dependent evolution of individual gas species, and the amount and characteristics of tar and char. The FG/DVC models will be integrated with BYU's comprehensive two-dimensional reactor model, PCGC-2, which is currently the most widely used reactor simulation for combustion or gasifi-

cation. The program includes: (1) validation of the submodels by comparison with laboratory data obtained in this program, (2) extensive validation of the modified comprehensive code by comparison of predicted results with data from bench-scale and process scale investigations of gasification, mild gasification and combustion of coal or coal-derived products in heat engines, and (3) development of well documented user-friendly software applicable to a "workstation" environment.

44556 **(DOE/PC/50001—44) Advanced coal liquefaction research: Technical progress report, October 1, 1986-December 31, 1986.** Gall, W.; McIlvried, H.G. III. (Energy International, Inc., Pittsburgh, PA (USA)). Mar 1988. Contract AC22-82PC50001. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88011823/JAW.

This report describes studies made during the fourth quarter of 1986 using the revised microautoclave experimental technique. Studies were made of the effect of reaction time on conversion using Kemmerer coal. Results that, at least during the first 30 minutes, conversion is a monotonically increasing function of reaction time and temperature. A study was also made of the effect of temperature on conversion. In general, conversion increased with temperature. The reactivity of coal appears to be unaffected by exposure to Certigrav fluid, if the exposed coal is subjected to two acetone washings under a nitrogen blanket. Work was started on using SCR-II process solvent in place of tetralin. Results indicate that SRC-II process solvent is a satisfactory solvent donor for high reactivity, high ash bituminous coals, but slightly less effective for low ash, subbituminous coals. Some tests were made to examine the effect of operating the Soxlett extraction equipment at higher temperatures. In general, higher temperature operations gave product yields 2–4 wt% higher than the uninsulated columns. 2 refs., 8 figs., 39 tabs.

44557 **(DOE/PC/79806—4) Characterization and suitability of superclean coals for hydroliquefaction feedstocks: 4th quarterly technical progress report ending June 30, 1988.** Kim, Nam K. (Michigan Technological Univ., Houghton (USA). Dept. of Chemistry and Chemical Engineering). 12 Jul 1988. Contract FG22-87PC79806. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013064/JAW.

The objective of the research is to evaluate the effect of superclean coals as produced from various domestic coals using MTU's flotation technology on direct coal liquefaction. The micronized and successively clean coals range from 1.0% to 20% in ash content and contain various sulfur concentrations. They are to be assessed as coal conversion feedstocks. Thus, the proposed project will evaluate the effects of ash, sulfur, and ultrafineness of coal feed on the hydroliquefaction process. The process development unit (PDU) was completed and clean coals were successfully produced at a 500 lbs per hour rate. The Pittsburgh {number←sign}8 and Lower Kittanning coals were used as the feed. Five samples having ash contents of 3%, 10%, 17%, 30%, and 43% were prepared from the PDU demonstration runs using Pittsburgh {number←sign}8, and they were analyzed for composition and other physical properties. These five coals have been tested for hydroliquefaction under the same operating conditions. The ultimate analyses of the liquid products showed that the low-ash coal yielded the most liquid. The iron content displayed a positive effect on the liquid yield. 1 ref., 10 figs., 4 tabs.

44558 **(DOE/PC/79908—T2) The hindered diffusion of coal liquids under non-reactive and high temperature and pressure reactive conditions: Quarterly report No. 2, December 15, 1987-March 14, 1988.** Tsotsis, T.T.; Sahimi, M.; Webster, I.A. (University of Southern California, Los Angeles (USA). Dept. of Chemical Engineering). 1988. Contract FG22-87PC79908. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013086/JAW.

Studies continued on the effects of the topology and geometry of a porous medium on its transport and reactive properties. The case where adsorption and diffusion of large macromolecules blocks the porous structure has been studied for the case of pillared clays. Recent results of our ongoing studies of diffusion phenomena under reactive conditions in porous catalysts with both uniform and nonuniform distributions of reactants are also reported. The current status of the rest of our work is as follows: Diffusivity studies using anodized alumina membranes are in progress. Diffusivity studies of water soluble porphyrins are currently in progress utilizing polycarbonate and mica membranes. Studies of asphaltene diffusivities in polycarbonate and mica membranes at room temperatures and atmospheric pressures are completed. We are testing our molecular dynamics numerical algorithm to describe hindered diffusion of spherical and disk shaped molecules through cylindrical pores. A classical continuum diffusion model has been developed to describe diffusion of asphaltenes through straight cylindrical pores. 54 refs.

44559 **(DOE/PC/79933—2) Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 2 for the period December 15, 1987 to March 14, 1988.** Massoth, F.E.; Seader, J.D. (Utah Univ., Salt Lake City (USA)). 31 Mar 1988. Contract FG22-87PC79933. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013731/JAW.

The aim of this research project is to develop a methodology to predict, from a knowledge of feed and catalyst properties, effectiveness factors for catalytic hydroprocessing of coal and coal liquids. To achieve this aim, it is necessary to account for restrictive diffusion, which has not hitherto been done from a fundamental approach under reaction conditions. The research proposed here entails a study of hydrogenitrogenation of model compounds and coal-derived liquids using three NiMo/alumina catalysts of different pore size to develop for restrictive diffusion, a relationship that can be used for estimating reliable effectiveness factors. During this period, the actual catalyst supports for preparing catalysts for the projct were received and evaluated. Construction of the reactor system was completed and minor changes in the design made. Preliminary, scoping reaction runs were carried out in a batch mode to estimate reaction conditions to be employed in the CSTR, and to develop analytical techniques or measuring reaction products. Some difficulty has been experienced in finding a suitable gasket for the corrosive environment of the reactor. 2 refs., 2 figs., 1 tab.

44560 **(DOE/PC/79933—T2) Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 3, March 15, 1988-June 14, 1988.** Massoth, F.E.; Seader, J.D. (Utah Univ., Salt Lake City (USA)). 30 Jun 1988. Contract FG22-87PC79933. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012686/JAW.

The aim of this research project is to develop a methodology to predict, from a knowledge of feed and catalyst properties, effectiveness factors for catalytic hydroprocessing of coal and coal liquids. To achieve this aim, it is necessary to account for restrictive diffusion, which has not hitherto been done from a fundamental approach under reaction conditions. The research proposed here entails a study of hydrodenitrogenation of model compounds and coal-derived liquids using three NiMo/alumina catalysts of different pore size to develop, for restrictive diffusion, a relationship that can be used for estimating reliable effectiveness factors. During this period, batch samples of catalysts were prepared from the alumina supports previously obtained and their properties were measured. Preliminary scooping runs with indole and nickel tetraphenylporphyrin were carried out to assess reaction conditions to be employed in the flow system and to develop analytical techniques for measuring reaction products. The flow reactor system was completed. 2 figs., 1 tab.

44561 **(DOE/PC/79934—T1) Catalytic gasification of coal chars by potassium sulphate and ferrous sulphate mixtures: First quarterly technical progress report.** Akyurtlu, J.F.; Akyurtlu, A.; Adeyiga, A.A. (Hampton Univ., VA (USA). Dept. of Engineering). 29 Apr 1988. Contract FG22-87PC79934. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013728/JAW.

The main objective of this investigation is to evaluate the catalytic activity of (K_2SO_4 + $FeSO_4$) mixtures in the steam gasification of coal and to compare it with that of K_2CO_3. The research has been planned such that the effects caused by chemical and physical properties of char upon gasification rate and product composition will be evaluated quantitatively. In the first quarter of study, literature review has been completed; procurement of equip-

ment and the design of the experimental setup has been initiated. 23 refs.

44562 **(DOE/PC/80023—T12) Development of an in-situ hydrogen measuring instrument for coal liquefaction processes: Quarterly report, January-March 1988.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract AC22-85PC80023. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88008106/JAW.

The objective of the project is to determine: (1) Hydrogen solubility in tetralin under the presence of ethane and methane. (2) Hydrogen mass transfer rate measurement of hydrogen-tetralin-methane and hydrogen-tetralin-ethane systems. (3) The rate and quantification of dehydrogenation of donor solvent liquids.

44563 **(DOE/PC/80507—T11) Catalytic coal gasification: Identification of active sites: [Progress report], April 15, 1988-July 14, 1988.** Falconer, J.L.; Lauderback, L.L. (Colorado Univ., Boulder (USA)). 18 Jul 1988. Contract FG22-85PC80507. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013767/JAW.

This research uses transient isotope tracing, at steady-state reaction conditions, in combination with surface analysis techniques (secondary ion mass spectrometry (SIMS) and x-ray photoelectron spectroscopy (XPS)). Carbon dioxide gasification of carbon blacks and coal char will be used initially, since this appears to be rate-determining during steam gasification; steam gasification will be used in later experiments. In a typical isotope tracing experiment, $^{12}CO_2$ flow over a carbon-catalyst mixture will be quickly replaced by $^{13}CO_2$ at the same pressure and flow rate. The changes in the concentrations of ^{12}CO and ^{13}CO products, and in the $^{13}CO_2$ and $^{13}CO_2$ concentrations, as a function of time, will be measured with a computer-controlled mass spectrometer. The use of isotope transients allows the concentration of active catalytic sites to be measured directly at reaction conditions and it allows the rate constant to be measured. Isotope tracing will be carried out as a function of reaction temperature, catalyst loading, catalyst type and carbon conversion. Surface analysis techniques will be used to determine the active forms of the catalysts. Model studies of catalyst-carbon interactions will also be carried out with SIMS in order to determine the form of surface species. The combination of isotope tracing and surface analysis will elucidate the details of the reaction mechanism. This insight into the mechanism of coal gasification will help in improving process kinetics for gasification.

44564 **(DOE/PC/90911—10) Reactivity of heteroatom-containing organics during liquefaction of subbituminous coal: Quarterly technical progress report, March 15, 1988-June 15, 1988.** Aulich, T.R.; Knudson, C.L.; Hawthorne, S.B. (North Dakota Univ., Grand Forks (USA). Energy and Mineral Research Center). 1988. Contract FG22-86PC90911. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013364/JAW.

Deuteration of AO4 liquefaction solvent to an isotopic purity of approximately 99% was accomplished using a teflon-lined Parr bomb reactor. Tubing bomb liquefaction tests were performed using two sets of reaction conditions including coal and AO4, and coal and deuterated AO4. The THF insolubles to be used in testing the stability of the deuterated AO4 under liquefaction conditions were extracted using a Soxhlet apparatus and methylene chloride solvent. A system enabling product slurry distillation directly from the tubing bomb following completion of the liquefaction reaction was designed, constructed, and utilized to recover and quantitate volatile fractions of product slurries. The AO4 solvent was also distilled using the same equipment and procedure. Weighed amounts of eight deuterium-labeled species were added to weighed amounts of both labeled and non-labeled AO4 in preparation for the four remaining tubing bomb tests. 3 figs.

44565 (EPRI-ER—5709-SR, pp 2.1-2.26) **Objectives of coal bioprocessing.** Narayan, R. (Purdue Univ., Lafayette, IN (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Bioprocessing of coal has two general applications: coal cleaning and coal conversion. The objectives of coal cleaning are clear-cut. Removal of certain elements and trace metals will produce a cleaner-burning fuel that has basically the same heating value as the original coal. The objectives of coal conversion are not so straightforward. The purpose is to produce new fuel forms; the forms and the processes that yield them differ significantly. Can bioprocessing be applied to a range of processes that require different reactions? Researchers in a variety of disciplines are studying coal bioprocessing. Will the systems being studied be applicable to coal? Should a new area of study previously neglected be explored? The author looks at the field of coal bioprocessing, at the work being carried out, and suggests some approaches that can be undertaken. 50 references.

44566 (EPRI-ER—5709-SR, pp 3.1-3.10) **Panel discussion on objectives of coal bioprocessing.** Lebowitz, H.; Karkalits, O.C.; Skidmore, D.; Gaddy, J.L.; Clausen, E.C.; Scott, C.; Thompson, B.; Blaustein, B.; Meyer, R.H. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Eight panelists discussed projects underway by their companies. One project was the design of a biological processing plant for converting Texas lignite to a gaseous product and liquid fuel in an underground salt cavern or mined cavity. Biological conversion of coal synthesis gas, production of methane, production of alcohols, research into coal solubilization by biological processes, enzymatic reactions of coal, and biological treatment of coal tar waste deposits were also described.

44567 (EPRI-ER—5709-SR, pp 4.1-4.24) **Microbial liquefaction.** Wilson, B.W.; Cohen, M.S. (Battelle, Pacific Northwest Labs., Richland, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

This overview begins with a review of the very short history of biological solubilization of coal, highlighting some of the early contributions. This presentation then addresses Battelle and University of Hartford work on screening of organisms, coal pretreatments, and solubilization of coal with cell-free extracts. Progress in the analytical chemistry of product materials is then discussed. The authors raise some of the issues they think are important for future progress in this area. 17 figures.

44568 (EPRI-ER—5709-SR, pp 5.1-5.17) **Panel discussion on microbial liquefaction.** Dahlberg, M.; Scott, P.C.; Hatcher, H.J.; McIlwain, M.; Yen, T.F.; Ward, B.; Powers, D. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—). Contract FG22-84PC70809.

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Research being done by the organizations represented by the panelists was described. Research programs included: the investigation into the chemistry and biochemistry of bioliquefaction of low-rank coals using Phanerochaete chrysosporium; coal desulfurization and solubilization; three methods of pretreatment of coal before biodegradation; screening of new fungi that solubilize a variety of coals and characterization of these organisms as to growth habits, activity on coals, and taxonomic identity; and the study of bacteria which should be able to upgrade the product of solubilized coal from a mass of benzene carboxylic acids to useful materials, i.e., methane, ethanol, methanol, etc.

44569 (EPRI-ER—5709-SR, pp 6.1-6.28) **Microbial removal of sulfur, nitrogen, and trace metals.** Isbister, J. (Atlantic Research Corp. (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Most research efforts in bioprocessing of coal have involved pyritic sulfur removal. New areas in research include removal of organic sulfur from coal, the potential for removing metals from coals, and microbial coal conversion processes, such as liquefaction and gasification. The objective of coal bioprocessing to be addressed in this discussion is beneficiation of the coal by removal of undesirable components (sulfur, ash, metals) to upgrade the coal in an efficient, economical process. 25 references, 13 figures, 14 tables.

44570 (EPRI-ER—5709-SR, pp 7.1-7.13) **Panel discussion on microbial removal of sulfur, nitrogen, and trace metals.** Kulik, C.; Tuovinen, O.; Finnerty, W.R.; Trantolo, D.J.; Fannin, K.F.; Rhee, K.H.; Stoner, D. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—). Contract AC22-85PC81201.

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

The topics discussed by panelists were: temperature dependence of bacterial catalysis; bacterial pyrite oxidation; fate of trace metals during acid dissolution; the development of a microbial system effective in the removal of organic sulfur from high-sulfur crude oil; a review of studies conducted on the use of microorganisms for removal of organic sulfur from coal; enzymatic desulfurization of coal; culture development on model compounds; biological assay of sulfur; evaluation of cultures on coal; various biological approaches to producing compliance coal; and understanding the biological mechanisms involved in the microbial desulfurization of coal.

44571 (EPRI-ER—5709-SR, pp 10.1-10.19) **Panel discussion on coal structure and microbial mechanisms.** Attia, Y.; Bean, R.; Ross, D.; Fish, R.H.; Knudson, C.L.; Huffman, G.P. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

The topics discussed include: the research problems encountered when considering procedures for determining structural changes brought about by coal biosolubilization; the problems associated with the use of model compounds and polymers in coal research; the study of depolymerization mechanisms of coal by electron transfer; NMR spectra of subbituminous coal and lignite; the biodesulfurization of coal and sulfur structure studies of coal.

44572 (EPRI-ER—5709-SR, pp 11.1-11.12) **Economic and engineering considerations of bioprocessing.** Jones, J.L. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Over the last 15 years, the chemical engineering staff at SRI International has evaluated a wide variety of bioprocesses (whole-cell processes and enzymatic transformations) for high-value therapeutic drug products, specialty chemicals, commodity chemicals, foods, fuels production and processing, and biodegradation for pollution control. The evaluation work done by SRI in some areas has been restricted to nonexperimental technical and economic evaluations of new concepts. In other cases, experimental studies have also been included to define critical process parameters and to establish technical feasibility. This paper discusses the feasibility of biosulfurization of coal from scientific, engineering, and economic viewpoints.

44573 (EPRI-ER—5709-SR, pp 12.1-12.20) **Panel discussion on economic and engineering considerations.** Siebenthal, C.; Dugan, P.R.; Kargi, F.; Kern, E.; Batchelor, J.; Zakheim, B.J.; Sproull, R.D. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

The topics discussed include: the need for engineering services as, at least, consultants in bioprocessing development; the economics of coal refining; microbial solubilization/liquefaction of coal; microbial desulfurization of coal and its economics; the process design of a 20,000 ton/day lignite processing plant for production of gaseous and liquid fuel; a review of DOE's work in coal preparation and liquefaction; cooperative activities between the US and foreign countries doing research in microbial coal cleaning; and the leaching of metals (Mg, Ca, Na, Al) from coal that occurs during bioprocessing.

44574 (EPRI-ER—5709-SR, pp 13.1-13.5) **Summary of key issues.** Atherton, L.F. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Most attendees agreed that the following were important issues: formulation of valid and consistent experimental procedures and definitions; selection of microorganisms and their integrity; knowledge about coal; identification of markets, the process economics, and timing; improvements in public relations and image; and effects of the regulatory environment. Issues of concern which are briefly discussed are: lack of quantitative results; use of fungi in coal processing; coal structure; and the lack of consideration given to the market for this research.

44575 (EUR—11340) **Industrial fuel gas fluidized bed pilot plant: Demonstration project: Final report, January 1984 to May 1987.** (Commission of the European Communities, Luxembourg; Coal Research Establishment, Cheltenham (UK)). 1988. 33p. NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012636/JAW.

A coal gasification pilot plant with a coal throughout of 12 tonnes per day has been installed at the Coal Research Establishment of British Coal. The aim of the project was to demonstrate, on a semi-commercial scale the production of a fuel gas for industrial furnaces and kilns. The plant consists of facilities for coal feeding, gasification, gas cooling and cleaning, gas combustion and waste disposal. The project commenced in January 1984. The plant was installed by April 1985; within timescale and cost. Full operation on coal was delayed until May 1986 because of problems relating to solids handling, start-up procedures and gas cooler design. Since May 1986 several extended operations have been carried out. Successful developments have been demonstrated in all areas of the plant. Coal conversions of 70% on a mass basis have been achieved with a gas calorific value of 3.8 MJ/M^3. Several coals were tested giving similar performances. Sulfur retention by the addition of limestone indicated that 80% of the sulfur that would be otherwise released in the gas can be retained. Alternative gas cleaning techniques have been evaluated and burner designs have been established for combustion of the low calorific value gas. Overall sufficient information is available to design a commercial gasifier. 6 figs.

44576 (FSC—8701) **82nd Special meeting on coke.** (Fuel Society of Japan, Tokyo). 23 Apr 1987. 55p. (In Japanese). (CONF-8704315—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW.

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

This report includes 10 papers about coal and coke. All papers deal with coke production in the steel making plants.

44577 (FSC—8701, pp 53) **Coking properties of extract residue from refined coal.** Mochida, Isao; Korai, Yozo; Tasaki, Masayuki; Okuhara, Toshiaki. (Kyushu Univ., Research Inst. of Industrial Science, Fukuoka, Japan; Nippon Steel Corp., Reserch and Development Labs. 3, Fukuoka, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

Five blends of coal was partially liquefied in the co-preheating process with hydrogenated tetrafluolantene as the additive. Tar was recovered and high-strength coke was produced from the extracted coal. THF solubles were obtained at a yield of 20 to 50 wt% by the single preheating or copreheating with the additive. Approximately 30 wt% in the THF solubles was benzene solubles.

The yields of gas and tar were higher than those in the chamber furnace carbonization. Since the coke produced by carbonizing the formed residual coal of THF insolubles obtained by the single preheating was isotropic and the mechanical strength was low, the coke was unable to be supplied to the blast furnace. Although the yield of tar extracted as the benzene solubles was increased to 11%, better coke was produced from the benzene solubles. The formed coke with high strength was obtained from the THF insolubles of the co-preheating residual coal, but it was isotropic. Anisotropic coke with extremely high strength was prepared from the benzene insolubles of it. (2 figs, 4 tabs, 8 refs)

44578 (FSC—8701, pp 53) **Measurement of coke size and weight by X-ray image processing system.** Nishimura, Masaru; Yamamoto, Hidehiko; Tanibata, Ritsuo; Nishikawa, Takashi; Nomura, Kazuo; Kato, Jiro. (The Kansai Coke and Chemical Co., Ltd., Research Lab., Hyogo, Japan; Mitsubishi Chemical Industries, Ltd., Research Center, Yokohama, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

Non-contact measuring system for coke size and weight utilizing X ray transmission has been developed. The dose of X ray transmitted through one particle of coke was measured every 1 mm interval in the particle with an X ray linear sensor. The respective two end points of the obtained linea data are connected to give the top view of the particle. The respective max. X ray attenuations are compared to each other and to the obtained max. value of attenuation from which the max. thickness of the particle is calculated. The top view of the coke particle is image-processed. A rectangular solid image having the three sides as long as the min. diameter, the diameter perpendicuar to the min. diameter, and the above max. thickness if figured. The weight of one coke particle is calculated from the total X ray attenuation of the particle. This system can be applied for evaluation of the rectangular mesh sieve amount of coke, and is useful for determination of coke drum index and particle size. (10 figs)

44579 (FSC—8701, pp 53) **Theoretical analysis of gas absorption by use of droplet model and its generalization.** Kugishima, Masahiro. (Kawasaki Steel Co., Tokyo, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

A dropet model was developed for modelling the numerical formula of the spray absorber used in various coke-oven-gas purification facilities. The absorption of vapor in the droplet was assumed that the vapor components reaching the gas boundary film surrounding a droplet moves to the interface of droplet where the vapor is dissolved in the liquid and diffused into the droplet. An unsteady diffusion model describing the variation of absorption with time was investigated based on the assumption mentioned above. Since the effect of the vapor on the amount of vapor absorbed in the droplet can be quantitatively determined, the operation result can be accurately estimated. The amount and yield of recovered gas oil in the gas-oil removing facilities and the concentration of H_2S at the outlet of desulfurization column of deslfurizer were able to be estimated at the average error within 2% or less and 4% or less, respectively. The cost was reduced by 5 to 10% by introducing the operation guiding system based on the droplet model. (7 figs, 3 refs)

44580 (FSC—8701, pp 53) **Operation improvement of the TAKAHAX desulfurization process.** Komura, Syoji. (Nippon Kokan K.K., Keihin Works, Kawasaki, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

The COG treating capacity of the TAKAHAX desulphurizer is 100,000 m^3/h. H_2S and HCN in the COG are absorbed by NH_3 to produce NH_4-salt. The exhaust liquid of TAKAHAX desulphurizer is oxidized together with the exhaust liquid from the sintering exhaust gas desulphurizer at high temperature under high pressure by the wet process to produce the mother liquor of ammonium sulphate. The operation of the desulphurizer was analyzed. The result indicates that the annual desulphurization ratio was improved by 1.5 to 2.0% by using NH_3 in the excess ammonia water even at the load of 120%. The steam used for the PHOSAM process was able to be saved by 25% by this improvement. Since the lower limit of catalyst was 0.8 mol/m^3, the catalyst saved was approximately 20%. The amount of air was reduced by 40% by improving the equipment based on the study on the diameter of bubbles of the oxidizing air. The deposition of sulphur was able to be controlled by the elucidation of reaction mechanism. (8 figs, 3 tabs)

44581 (FSC—8701, pp 53) **Start-operation with light oil for coke oven battery.** Matsui, Takayoshi; Mokudai, Takehiko; Tamura, Yoichi; Kimura, Masato. (Nippon Steel Corp., Yahata Works, Fukuoka, Japan; Nippon Steel Corp., Tokyo, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

BaO-shan Iron Works completed the start-up operation without any big trouble in 1985 though the construction was behind schedule since 1978. The maintenance of the temperature distribution of the coke oven had been regarded as difficult for drying it up with light oil. The partial temperature-distribution during the heating up of the oven body which had been worried about at the beginning was able to be maintained in the same manner as in the drying with COG though there was a trouble with clogging up of the burner tip. A high-pressure atomizing burner was used for the light oil burner. The combustion was controlled by the combination of the main pressure, the pressure difference between the air and the light oil and the change of nozzle tip diameter. The temperature distribution in the lengthwise direction of flue shows that the temperature at the centre increases with increasing of the temperature of the whole flue. Although there are some differences in the expansion at various positions by drying between the light oil and COG, the whole tendency in the expansion is hardly different from each other. (6 figs)

44582 (FSC—8701, pp 53) **Automatic observation and hot-repairing system for coke-oven inner wall.** Omae, Yoshihiro; Ishikawa, Kunio; Maeda, Shin'ichiro; Ikeda, Yoshiaki. (Mitsubishi Chemical Industries, Kurosaki Plant, Niigata, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

An automatic observation and furnace wall repairing system in the carbonization chamber of coke oven. The system comprises the scanning part such as lance, lance box, tower and moving truck and the control part including the control room. This is a repairing machine having the functions such as photographing and recording the inner situation of oven, determining the positions to be repaired, pretreating and repairing the positions. The repairing machine has programs to observe the inner situation of oven from the door of oven, lay the bricks and repair the joint. Sand blasting is carried out before repairing the wall. 'Injection Adhesion Method' was developed to repair the wall of oven. The repairing material is discharged from the nozzle to adhere it to the part to be repaired. The adhered material is oxidized by supplying oxygen or air and cured by the heat generated with the lapse of time. Since the repairing material is the mixture of an oxidizable exothermic metal and a binder, no heat source such as propane and plasma is required. (4 figs)

44583 (FSC—8701, pp 53) **Heating chamber wall strength of coke oven.** Fujihira, Koichi; Ito, Yu; Otsuka, Jun'ichi; Karino, Tsuyoshi; Murakami, Fujio. (Nippon Steel Corp., Tokyo, Japan; Nippon Steel Corp., Iwate, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

The strength of hot wall of running furnace was examined and the strength of bricks laid for repairing was evaluated. The strength of wall under the whole load evenly distributed is regarded as about 0.1 kg/cm² from the cold model and the practical hot furnace test. Although the maximum pressure caused by the expansion of coal and the maximum side pressure caused by discharging the coke may be higher than that value, the structure of oven is not affected by those pressures due to the partial pressure. Defining the whole wall of carbonization chamber considerd as a structure as the 'whole wall' and a layer of bricks as the 'single structure', the theoretical comparison that the strength of the 'single structure' is higher than that of the 'whole wall' was experimentally identified. It is important, therefore, to take the strength of 'whole wall' into consideration. Although the strength of repaired boundary is decreased by the hot repairing compared with that of other parts, the pressure resistance is as high as about 6 kg/cm². That strength is, therefore, considered practically safe. (5 figs, 1 tab, 8 refs)

44584 (FSC—8701, pp 53) **Influence of CDQ-coke produced from low quality coal blend on blast furnace operation.** Yaya, Shuji; Kasaoka, Shizuki; Nishimura, Hirofumi; Yamazaki, Makoto; Akizuki, Hidemi. (Kawasaki Steel Corp., Mizushima Works, Okayama, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

It is considered that the strength of CDQ-coke is so much higher than that of wet coke that the quality of coal blend for the CDQ-coke can be lowered compared with that for the wet coke. The effects of lowering the quality of coal blend on the strength of CDQ-coke and the operation of blast furnace were examined in the ordinary supply method. When the MF value of the coal blend was decreased to 2.25 and the average reflectance of it was decreased to 1.00, the strength of coke was affected by the resistance to wear more than by the cold strength, lowering from 84.5% to 83.0%. It is estimated that the decrease of 1.5 points is marly equal to that of wet coke. The effect of the resistance to wear on the operation of blast furnace was not so large in the experiment though it was observed. The effect of lowering the resistance to wear on the operation of blast furnace may be alleviated by increasing the CDQ-ratio in the blast furnace. (11 figs, 1 tab, 5 refs)

44585 (LBL—25416) **Fundamental studies of catalytic gasification: Quarterly report, April 1, 1988--June 15, 1988.** Heinemann, H.; Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014044/JAW.

During the present quarter, gasification of two new chars in the absence and presence of various catalysts was carried out. A subbituminous and a bituminous char have been steam gasified, both before and after demineralization, using K-Ni, K-Ca, and K-Mg catalysts. Chars derived form the younger coals were easier to gasify. Ash components in the lignite and subbituminous chars provided some catalytic action. K-Ca is a good gasification catalyst, exhibiting slightly less activity than K-Ni but being more resistant to deactivation by ash components. K-Mg appears to be somewhat less active that K-Ca. The calcium content of the ash may play a very important role in the rate of gasification. Work suggests that composition of the ash determines which catalyst is more effective and in what amount to use it. Activation energies for all chars tested thusfar and for all catalysts tested are in the same range, 54-63 Kcal/mole. 14 figs., 2 tabs.

44586 (NEDOJ—8703, pp 16-34) **Development of centrifugal slurry pump for coal liquefaction plant.** Sasaki, Manabu. (Mitsubishi Heavy Industries Ltd., Takasago Machinery Works, Hyogo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The centrifugal slurry pump for the coal liquefaction plant was developed to provide the design guideline to the pump for the commercialized plant. The specifications of the pump for the commercialized plant are as follows: flow rate is 400 m³/n; head is 1773 m; number of revolution is 1780 rpm; delivery pressure is 200 kg/cm²g; suction pressure is 5 kg/cm²g; liquid to be sent is the slurry of coal derived liquid and pulverized coal; liquid temperature is normal temperature; viscosity is 200cp; and concentration of slurry is 33 to 40 wt%. A vertical type 14-stage pump was manufactured on an experimental basis and the attrition test was made continuously running the pump for 2000 hours. The maximum peripheral velocity of the impeller was fixed to 38.5 m/s from the experimental result. It was confirmed that the service life of pump made of high-Cr cast iron or SiC ceramics is expected to be one year or longer. The design guideline to the vertical type 31-stage pump serviceable for one year or longer for the commercialized plant was established from the evaluating formulas expressing the attrition rate of the material of each part. (10 figs, 9 tabs)

44587 (NEDOJ—8703, pp 35-46) **Development of production technology of high BTU gas.** Takeuchi, Hideaki. (Electric Power Development Co., Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The purpose of this project was to produce the fuel for industry and city gas by gasifying the mixed slurry of coal and heavy distillate in a pilot plant of pressurized fluidized-bed gasifier. The experimental pilot plant result indicates that the goal of development was attained because the cold gas efficiency reached 75% and the total operating time was as long as approximately 2900 hours. Some bulk substance was, however, produced in the furnace during the experiment. This is because the ash in char was welded to the inside of furnace by the local superheating. Therefore, the sectional area of lower passage of furnace was reduced by half and new feeding nozzles of gasifying agent into the intermediate and lower stages were installed. The installation of the nozzles made the temperature of thermal decomposition zone higher and improved the cold gas efficiency as well as solved that problem. The test was made to decrease the steam/slurry ratio, reduce the heavy distillate and use diversified ranks of coal. The situation of worn and corroded parts of main components was examined on the occasion of dismantling the pilot plant. (8 figs)

44588 (NEDOJ—8703, pp 6-15) **State of research and development of bituminous coal liquefaction by bench scale unit.** Nagata, Ken'ichi. (Mitsui Engineering and Shipbuilding Co., Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The experiment of coal liquefaction by the 0.1 t/d-bench scale unit was carried out in FY1986 using Wandoan, Illinois, Wyoming, Battle River and Taiheiyo coals to support and supplement the design of a 250 t/d-pilot plant based on the NEDOL process. The findings including the characteristics of the liquefaction reaction in the NEDOL process, material balance, and chemical and physical properties and their variations with time of the circulating solvent and product were obtained by the experiment. The stable circulating operation in the whole plant was carried out using any of the five ranks of coal. The yield of the fraction boiling at 350°C or under decided to 50 wt% or more as the target of NEDOL process was attained. In the distillation process of coal derived liquid, it was cut at 538°C to obtain the residue softening at 180°C or higher and containing 30 wt% or more of ash though the difficulty of drawing the residue out of the equipment varies according to the ranks of coal. (4 figs, 2 tabs, 3 photos)

44589 (NEDOJ-P—8508) **Survey on the possibility of using coal-liquefied oil as a raw material and on the technology development(Part 2).** (New Energy Development Organization, Tokyo (Japan)). Mar 1986. 127p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754195/JAW.

It is a basis for establishing the future comprehensive coal utilization technology that the economical liquefaction process is

established by attempting to use compounds with high added value in the coal liquefied oil. In this report, mainly on polycyclic aromatic compounds, the present status of utilization, separation/purification technology, and the future prospect of its utilization were examined. It was clarified that the content of polycyclic aromatic compound is high and that there is a high possibility of utilizing it for the raw material for the chemicals or highly functional materials by the wise use of its unique structure. (71 figs, 38 tabs)

44590 **(NP—8770323) Hydrogasification of Rhenish brown coal.** Michenfelder, A. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). 24 Oct 1986. 178p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770323/JAW.

The hydrogasification of Rhenish brown coal was investigated for two different types of coal (ash content 3.5% and 17%) in a cross-flowed laboratory-scale fixed-bed reactor at hydrogen pressures up to 5 MPa and heat-up rates of 4 K min/sup -1/ and 100 K s/sup -1/. Pyrolysis analyses (carried out in addition to titrometer measurements of oxygenous functional groups for the purpose of establishing a molecular model of brown coal) showed an extremely low dependence of the pyrolysis conditions on the product yield and product spectrum. Pyrolysis is found to be a function of the molecular structure of the brown coal. At a minimum hydrogen pressure of 5 MPa and a gasification temperature higher than 950/sup 0/C, selective gasification of coal into methane (hydropyrolysis) takes place within a few minutes, so that slow hydrogasification of residue is unnecessary.

44591 **(PB—88-211958/XAB) Design and economics of a lignite-to-SNG (substitute natural gas) facility using Lurgi gasifiers for lignite gasification with KRW gasifiers for gasification of coal fines. Topical report (Final), April 1985-January 1986.** Smelser, S.C. (Fluor Technology, Inc., Irvine, CA (USA)). Jan 1986. 118p. NTIS, PC A06/MF A01.

A first-pass design and cost estimate was prepared for a plant to convert lignite to substitute natural gas (SNG) using Lurgi dry-bottom gasifiers to gasify the coal and the KRW fluid-bed gasifiers to gasify the coal fines. The overall plant thermal efficiency is between that of the Lurgi and KRW base case designs. The study-case design is of commercial interest compared to a Lurgi plant when the Lurgi plant coal fines cannot be sold. The study case is more capital-intensive because it requires more-expensive boilers and more of different types of process units than either base case. There is no advantage over a KRW plant design that provides a 30% lower cost of gas.

44592 **(UCID—21442) Activation energy distributions and related chemistry for pyrolysis of the Argonne Premium coals.** Burnham, A.K.; Oh, Myongsook S.; Crawford, R.W.; Samoun, A.M. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014187/JAW.

We report pyrolysis yields and kinetics for the eight Argonne Premium coal samples measured by modified Rock-Eval pyrolysis and by pyrolysis interfaced to triple-quadrupole mass spectrometry (TQMS). Pyrolysis temperatures from pyrolysis-TQMS were consistent with those from Rock-Eval considering that only gas and naphtha were monitored by the TQMS. Rate data at three heating rates from the Rock-Eval apparatus were analyzed using Gaussian and discrete activation energy distribution models. Although T/sub max/ increases with coal rank, the average activation energy is lower for high volatile bituminous coals than for lower or higher rank. The activation energy distribution became substantially narrower as carbon content increased and oxygen content decreased. The evolution profile of most compounds measured by TQMS indicated the presence of activation energy distributions, multiple generation processes, or both. A Gaussian distribution is usually not a very good approximation when a distribution in activation energy is required, either for individual compounds or for total hydrocarbons. The TQMS data also showed that T/sub max/ for different compounds had different dependencies on coal rank. Methane was relatively constant, but others generally increased with coal rank. The decrease in activation energy distribution width with increased coal rank is attributed in part to a convergence of T/sub max/ values of different species at high coal rank. Finally, we discuss the validity a parallel reaction approach for modeling both coal processing and geological maturation. 44 refs., 16 figs., 6 tabs.

44593 **Condensed and gaseous products chemistry in the combustion and gasification of high-sulfur coal.** Sinka, S.; Natesan, K.; Blander, M. (Argonne National Lab., 9700 South Cass Avenue, Argonne, IL (US)). pp 72-82 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

A recently developed computer program, based on geometric programming, is used to calculate condensed gaseous products chemistry in the combustion of conversion of high-sulfur Illinois #6 coal. Under 30% air-excess and 30% air-deficient conditions, product chemistries were calculated as a function of temperature. For the temperature ranges of 1800-1100 K, condensed phases are saturated with solid silica, and the major "Na" and "Cl" bearing gaseous species are NaCl and HCl. The concentration sulfates (under oxidizing conditions) or sulfides (under reducing conditions) in this silica-saturated molten silicate solutions increases progressively with a decrease in temperature. The liquid condensates appear to be more complex than believed, and "hot corrosion" by silicates could be important.

0105 By-products

REFER ALSO TO CITATION(S) 44678, 45231

0106 Properties

REFER ALSO TO CITATION(S) 44557, 44567, 44571, 44574, 44578, 45438

44594 **(ANL/FE—87-8) A feasibility study on advanced techniques for on-line monitoring of coal slurry viscosity.** Sheen, S.H.; Raptis, A.C. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31-109-ENG-38. 39p. NTIS, PC A03/MF A01;1; GPO Dep. Order Number DE88010519/JAW.

In the first part of this feasibility study, the coal-slurry rheological data available in the literature were surveyed. The rheological properties of coal slurry are very complex. A dilute coal-water slurry, less than 15% by weight, behaves as a Newtonian fluid with a constant viscosity. However, slurries higher coal concentrations show non-Newtonian behavior which can be described by a power-law relation between shear stress and shear rate. Since slurry viscosity is a function of shear rate, a slurry viscometer must be designed to measure both viscosity and shear rate. Commercially available viscometers were also surveyed; they are mostly laboratory units operating at low shear rates and based on mechanical sensing devices. Their application to on-line monitoring is limited. The second part of the study concerns the technical evaluation of ultrasonic methods applied to slurry viscosity measurement. The four ultrasonic techniques examined were measurements of attenuation, acoustic impedance, relaxation, and acoustic streaming and cavitation. Acoustic impedance measurements are more sensitive to slurry viscosity than to any other fluid parameter. The three other techniques measure acoustic attenuation, but in different frequency ranges. Results from this study indicate the feasibility of developing an on-line ultrasonic viscometer based on the measurement of either acoustic impedance or acoustic streaming and cavitation. 39 refs., 16 figs., 5 tabs.

44595 **(DOE/PC/70799—T13) Identification of nonvolatile coal derived products via chromatography coupled with on-line FTIR detection: Final report, September 1, 1984-August 31, 1987.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Apr 1988. Contract FG22-84PC70799. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010170/JAW.

The research reported here builds upon our efforts during the initial three year grant period regarding the interfacing of Fourier transform infrared spectrometry with size exclusion and normal phase chromatography for the analysis of coal-derived products. Four objectives were proposed: (1) optimize the HPLC-FTIR interface in terms of detectability, identifiability and chromatography, (2) extend the HPLC-FTIR approach to reversed phase chromatography wherein more efficient separations are possible for heteroatom species, (3) determine the feasibility of interfacing supercritical fluid chromatography with FTIR for the analysis of coal-derived products and (4) employ hyphenated methods to ascertain on a molecular level the changes that occur in a nonvolatile coal derived product when various liquefaction parameters are varied. Highlights of the 36-month study are listed followed by a brief synopsis of our major findings. 11 figs., 1 tab.

44596 **(DOE/PC/79907—T2) Spectroscopic study of coal structure and reactivity: Quarterly report.** Griffiths, P.R. (California Univ., Riverside (USA). Dept. of Chemistry). 14 Apr 1988. Contract FG22-87PC79907. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013083/JAW.

In previous work from this laboratory it was observed that the rate of oxidation of a high rank coal (as monitored from its infrared spectrum) was dependent on the size of the coal particles. To extend this work, samples of three different Pennsylvania coals -- a low volatile, medium volatile, and high volatile bituminous coal -- were ground for different periods of time in a ball mill grinder; the longer the coal is ground, the smaller is its average particle size. Aliquots of each sample were heated to 200{degree} and 250{degree}C, with samples being withdrawn at intervals. The diffuse reflectance spectrum of each sample was measured without dilution in an alkali halide diluent. The diffuse reflectance spectra of each coal before oxidation and representative spectra of the coal before and after air oxidation are presented. Techniques for improving the repeatability of coal extraction in solvents of intermediate polarity were also investigated. When coal extracts in chloroform were added to KCl powder, with the intention of evaporating off the solvent and measuring the diffuse reflectance spectrum of the residue, chloroform bands were always observed in the spectra. Apparently a reaction was taking place between chloroform and KCl. 2 refs., 4 figs.

44597 **(DOE/PC/79917—T2) NMR investigation of supported metal catalysts for syngas conversion: Quarterly technical progress report 2.** (Grambling State Univ., LA (USA). Dept. of Physics). 15 Jun 1988. Contract FG22-87PC79917. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011879/JAW.

This report describes the work carried out during the second quarter. As outlined in the proposal, studies on the physically admixed catalysts with and without the promoter thoria have been completed and the results are presented below. The physical mixture of the metal precipitate/promoter and the support, is reduced in a flowing stream of hydrogen at 500{degree}C for 16 hours and the NMR and magnetic experiments were made both on the sealed samples, and samples exposed to air. There was no apparent difference in the spectra of the sealed and exposed samples.

44598 **(DOE/PC/80517—T11) Improving the stability of coal slurries: Quarterly progress report, March 15, 1988-June 15, 1988.** Fogler, H.S. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 1988. Contract FG22-85PC80517. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012695/JAW.

To complete the study on the effects of electrostatic interactions on stability and peptization, (1) the conformation of poly (galacturonic acid), PGUA, in solution, (2) the effect of the electrostatic repulsion between particles on the stability, and (3) the cause of the peptization of the sulfate latices were investigated. The static light scattering experiment showed that the PGUA molecules are stretched at high pH due to a strong electrostatic repulsions between charged segments. The conformation of PGUA in solution agreed with the steric layer thickness data which had shown that PGUA molecules take a flat conformation on the surface at high pH. The zeta potential measurements showed that the electrostatic repulsion between the PGUA-covered latices is not strong enough to influence the stability. This zeta potential data substantiated that the stabilization caused by PGUA is due to a steric repulsion. The stability data had also indicated that the electrostatic repulsion is negligible because the stability had been found to be greater at lower pH where the steric layer thickness is greater than at higher pH. The photon correlation spectroscopy study showed that the steric layer thickness of the PGUA adsorbed on the sulfate latices increased from 6 nm to 20 nm within 2 minutes. This increase of the steric layer thickness was found to be the cause of the peptization of the sulfate latices. 6 refs., 6 figs., 1 tab.

44599 **(DOE/PC/90527—T6) Characterization of oxidized coal surfaces: Quarterly report, February 1988-April 1988.** Hercules, D.M. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). 1988. Contract FG22-86PC90527. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013768/JAW.

Work has progressed in the area of applying derivatization and analytical procedures developed for model compounds to oxidized coal samples. Both SIMS (Secondary Ion Mass Spectrometry) analysis have been pursued. Data obtained with TAB (4-triethylammonium-1-chloro-2-butene) derivatization is particularly encouraging. Coal samples have been oxidized in the reactor described in previous quarterly reports. The progress of the oxidation was monitored using Diffuse Reflectance Infrared Fourier Transform (DRIFT) spectroscopy. DRIFT results confirmed that changes in oxygen functionality were occurring under the conditions and in the time frame of the reactor experiments. The potential of 2-fluoro-1-methyl pyridinium (FMP) as a derivatizing reagent for alcohols was also explored. Preliminary results show it to be useful. 7 refs., 4 figs.

44600 (EPRI-ER—5709-SR, pp 8.1-8.42) **Coal structure and microbial mechanisms.** Chung, K.E.; Goldberg, I.B. Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Chemical structure characteristics of a Wyoming subbituminous coal, a Texas lignite, and an Illinois bituminous coal were determined by controlled solubilization of each coal, solvent fractionation of the product, and detailed analyses of the product fractions. Material and elemental balances revealed that the oxygen function groups of each coal were attacked selectively in the solubilization process, resulting in an orderly, definable diminution of the complex coal structure. Structural information obtained on each coal includes the distribution and arrangement of oxygen functional groups, aromatic clusters, linkages between the clusters, and side chains on the clusters. The structural characteristics were used to construct molecular structural models specific to the coals examined. Also, the structural data were related to their hydroliquefaction yields, such as potential products, their distribution, and hydrogen consumption. The arrangements of aromatic clusters and functional groups were similar in all three types of coal. Two to four aromatic clusters of similar size are linked to each other by alkyl C-C bonds, making a chain of aromatic clusters. Two or more of these chains are connected to each other by ester and ether groups. The size of aromatic clusters ranges from single-ring to five fused-ring clusters. The three coals are different in the distributions of aromatic clusters and oxygen functional groups. The lignite and bituminous coal contain fewer large aromatic clusters than the subbituminous coal, although they contain similar amounts of single-ring and two fused-ring aromatic clusters. Hydroxyl and ether groups contain more of the oxygen in lignite than the ester and carbonyl groups. However, the ester and carbonyl groups contain more of the oxygen than hydroxyl and ether groups in the subbituminous coal. Most oxygen of the bituminous coal was in ether and hydroxyl groups.

44601 (EPRI-ER—5709-SR, pp 9.1-9.10) **Coal structure and microbial mechanisms: a summary.** Olson, G.J. (National Bureau of Standards (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88008476/JAW. (CONF-8702135—).

From 1. annual workshop on biologic processing of coal; Monterey, CA, USA (17 Feb 1987).

Microbial processes have the potential to be useful in coal depolymerization or liquefaction, deoxygenation, and cleaning. Minerals associated with coal may also be removed through microbiological activity. The information gained in studying microbial coal processing will also help investigators interested in determining coal structure. Basic mechanisms of coal liquefaction and demineralization should be further investigated. Better measurement methods are needed to determine sulfur specification in coal in order to design the most efficient microbial processes. Toxic trace elements present in coal may result in inhibition of microbial processes. Perhaps the observed variability of liquefaction or demineralization processes are the result of such inhibitions. 20 references.

44602 (FSC—8701, pp 53) **Fluorescence of vitrinite and its influence on fluidity.** Sasaki, Masahiro; Takahashi, Ryohei. (Nippon Steel Chemical Co., Ltd., Tokyo, Japan; Kyushu Univ., Fukuoka, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

The fluorescent intensity of vitrinite in 16 ranks of coal from US, Canada, Australia and Japan was investigated to obtain the relationship with fluidity of coal. The fluorescent intensity was classified into the part, IR, regularly varying according to the carbonization degree and the other part, IS, irregularly varying according to the geological conditions, and the fluidity, MF, was correspondingly classified into MFR and MFS. Then the relationship between IS and MFS was determined. The result indicates that the coals used for the study can be classified into three groups, US/Canada, Australia and Japan. When IS is equal to each other, MFS of the Australian group is larger than that of the US/Canadian group. Probably this is because there are differences in the softening and melt properties between them. The order of IS is Japanese coal, US coal and Canadian and Austrian coals. It is considered that IS varies according to the amount of accumulated organic host material and the initial reducing carbonization conditions. (4 figs, 2 tabs, 5 refs)

44603 (FSC—8701, pp 53) **Effect of heating rate on volatile matter of coal. Development of automatic technical analyzer of coal.** Tajima, Ryuji; Asada, Shingo; Tanibata, Ritsuo. (The Kansai Coke and Chemicals Co., Ltd., Research Lab., Hyogo, Japan). 23 Apr 1987. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754190/JAW. (CONF-8704315—).

From 82. special meeting on coke; Tokyo, Japan (23 Apr 1987).

An automatic technical analyzer was developed for estimating the volatile matter content of coal specified in JIS M-8812 from the loss on heating at any heating rate ranging from 150 to 300°C/min using the thermobalance. The variation of loss on heating of coal according to the heating rate was examined. Comparing the relationship between the heating rate and the element ratio of H/C with that between the heating rate and O/C using 18 ranks of coal, the latter is closer than the former. Meanwhile, the volatile matter content specified in JIs is closely related to H/C. Since the general coals are within the same coal band, it was found that the volatile matter content in the sample coal specified in JIS is corelated with O/C. The volatile matter content specified in JIS can be, therefore, estimated from the loss on heating at any heating rate. The difference between estimated value and actually found value is within 0.2% or less, which is practically allowable accurate. (6 figs, 2 tabs)

44604 (NP—8770318) **Kinetics of organic particle swelling as illustrated by the example of coal.** Polte, D. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Verfahrenstechnik). 15 Dec 1986. 184p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770318/JAW.

The model is based on the elementary mass, volume and balance equations. Materials data functions and other characteristic data are calculated according to physical model assumptions as far as possible. Coal pyrolysis is calculated by an approach comprising two secondary reactions. For the reaction rates of irreversible reactions at constant heating rates, first order approaches with a superposed Elovich function as referred to the initial concentration are formulated. Diffuse fluid phase transport is taken into account. For gas bubbles of a given size distribution, balance equations comprising an accumulation term, a dispersive transport term, and a source term are formulated. Parallel to the establishment of the mathematical model, measurements were carried out on the swelling kinetics of coal particles. Seven different bituminous coals were investigated, each with two different grain sizes. The measurements correlate well with the calculations.

0108 Waste Management

REFER ALSO TO CITATION(S) 44546, 44580, 44941, 45138, 45575

44605 (IVA—310, pp 139-156) **Handling of waste from coal-fired power stations.** Hueller, R. (Westdeutsche Gipswerke, Iphogen (Federal Republic of Germany)). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

Cleaning flue gases of power stations fired with fossil fuels, produces considerable quantities of waste materials. A decisive requirement for choosing the desulphurization process is to arrange for the dependable and long-term disposal of these wastes. Dry, semi-dry, and wet desulphurization processes, using lime products as an absorbent, predominantly produce normal fly-ash (fly-ash), calcium oxidic or calcium hydroxidic fly-ash (DAP fly ash), calcium sulphate (flue gas gypsum), calcium sulphite (dry product), and filtered matter (waste water), either on their own or as a mixture. Processing methods for the utilization of flue gas gypsum from wet flue gas cleaning, such as drying or agglomeration, have been in use for a considerable length of time. A promising possibility for the future would seem to be the combined utilization of the flue gas desulphurization product and fly-ash as landfill and landscaping materials.

44606 (NP—8770324) **Physical, chemical, and mortar analyses of fly ash from coal power plants.** Lü Shanhou. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 15 Oct 1986. 182p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88770324/JAW.

Fly ashes from a melting furnace and several dry furnaces fuelled with German coal were analyzed for their constituents. Quantitative mineral analyses showed the main constituent to be a vitreous mass whose SiO/sub 2/ concentration decreases as the quartz concentration in the fly ash increases. A decreasing concentration of Al/sub 2/O/sub 3/ in the vitreous mass corresponds to an increasing concentration of mullite. Further, minor constituents are free lime, anhydrite, haematite and magnetite, depending on the concentrations in fly ash of these oxides. Blaine's air permeability method was not quite satisfactory in determining specific surfaces if concentrations of coarse-grained (> 63 μm) constituents are high. Better results are expected of laser granulometers.

44607 (NP—8770333) **Influencing parameters in the solidification of coal fly ash using hydraulic binders.** Al-Mahmoud, M. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 13 - Wasser und Verkehr). 25 Apr 1986. 274p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88770333/JAW.

Recovery of industrial by-products is desirable both for economic and for ecological reasons. Fly ash from coal power plants, e.g., can be used in road construction after solidification with suitable binders. The author investigated the influence of ash origin, binder type and volume, water content, holding times during processing, solidifaction rate, and hardening time on the compressive strength, flexural tensile strength, fatigue life under flexural tensile stress, and freezing characteristics. Ash samples from four power plants were used, together with the binders PZ 35 P and Pentacrete. Fly ash from coal combustion was found to have good solidification characteristics with low binder additions if the effects of the various production process parameters are taken into account.

44608 (PB—88-201207/XAB) **Medium-sulfur coal and fly-ash resistivity.** Harrison, W.A.; Nicholson, J.K.; DuBard, J.L.; Carlton, J.D.; Sparks, L.E. (Southern Research Inst., Birmingham, AL (USA)). Feb 1988. 10p. NTIS, PC A02/MF A01.

Pub. in Jnl. of the Air Pollution Control Association, Vol. 38, No. 2, 209-216(1988).

This paper describes a project to expand the data base of sulfur oxide concentrations, in-situ fly-ash resistivities, and electrical operating points measured in operating utility fly-ash electrostatic precipitators (ESPs). Recent data are presented. In-situ resistivity data are compared with laboratory measurements and mathematical predictions. Electric-generating plants burning medium-sulfur coal need a way to predict when ESP performance will be limited by high resistivity of the collected fly-ash. The main uncertainty in mathematical predictions of fly ash resistivity lies in the marginal effect of sulfur trioxide vapor naturally occurring in the flue gas. A revised version of the resistivity predictor gives results in agreement with values measured both in-situ and in the laboratory.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 45687, 45688, 45751, 45854, 45865

44609 (PB—88-214325/XAB) **Fundamental studies on the relationship between quartz levels in the host material and the respirable dust generated during mining. Volume 1. Experiments, results and analyses. Open File report (Final) September 1985-September 1987.** Ramani, R.V.; Mutmansky, J.M.; Bhaskar, R.; Qin, J. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). Sep 1987. 180p. NTIS, PC A09/MF A01.

See also PB—87-181855.

The overall objective of this study is to contribute to the reduction of the quartz dust hazard in underground coal mines through a better understanding of the sources and generation of airborne quartz dust. The research project has included extensive experiments in operating mines for (1) documenting the amount of respirable dust generated, (2) measuring the quartz levels in host materials and airborne dust, (3) analyzing the size consist of the mined product, and (4) establishing the relationship between these various parameters. The results of the study indicate that the amount of dust airborne is a very small fraction of the total (<15 micrometers) and respirable (<7 micrometers) dust generated. The quartz contents in the total and respirable airborne dust are generally higher than those in the host material. Quartz content increases with decreasing size of airborne dust. Also, it appears that rock breaks into a different size distribution than coal.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 45111

44610 (NEDOJ—8703, pp 481-508) **Survey of geological structure in Liuchuang mine concession of Chunnan coal field in Anhwei Province, People's Republic of China.** Minami, Akira. (Mitsubishi Mining and Cement Co., Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

Under the guidance of the New Energy Development Organization, a survey group has smoothly carried out a five-year joint survey with Chinese experts, while promoting friendly mutual relations, and compiled a report of a geological survey for coal mine construction. The mine concession was located in a potential coal field and had a relatively monotonous, stable geological structure. A general survey was conducted by a combination of seismic investigation and rock frilling. The interval between the traverse lines used for seismic investigation was basically 400 m x 500 m while it was 400 m x 250 m in the western area where the geological structure was complicated. Rock drilling in principle was performed along the odd-numbered traverse lines (at intervals of 800 m) for the seismic investigation, with drilling intervals of 750 - 1,500 m. Most coal seams consisted of alternating layers of dull coal and bright coal. The total coal reserves was theoretically predicted to be 1.59 billion tons while the total geological safety coal reserves was estimated at 1.18 billion tons. Investigations of coal seams, coal quality, hydrology and geology were completed and successfully provide geological data required for designing and development of coal mines. (11 figs, 14 tabs)

44611 (NEDOJ—8703, pp 509-534) **Basic survey for coal resources development in sea area off Nishisonogi.** Yagi, Shozo. (Matsushima Coal Mining Co., Ltd., Fukuoka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

A physical survey and marine drilling have been conducted in sea area off Nishisonogi of Nagasaki Prefecture since 1982 to determine the potential coal resources reserves and to provide information required for clarifying the geological conditions. This report presents results of five marine drilling suryeys performed in years until 1986 and physical investigations made in years until 1984. Not many coal seams have been identified by drilling in the area under investigation. Results of the drilling coupled with those of the physical investigations generally suggest that the coal seams tend to slightly deteriorate along paths from northwest toward southeast. Large variations in coal quality are not seen among coal seams, which contain high-quality bituminous coal. The physical investigation consists of preparation work, survey, data processing, analysis and geological interpretation. The survey includes electrical logging; density, gamma and caliper logging; sonic logging; well shooting; and dipmeter logging. It is revealed that coal seams are extending continuously and that the geological structures are stable. (11 figs, 5 tabs)

0120 Mining

REFER ALSO TO CITATION(S) 44610, 44611

44612 (NP—8770340) **Possibilities for transferring experiences gathered in German black coal mining with the mechanization of longwall mining and tunneling to coal mining in the People's Republic of China.** Feng Weimin. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Bergbau und Geowissenschaften). 19 Dec 1985. 198p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770340/JAW.

In the People's Republic of China, one of the biggest coal producers of the world, coal carries great weight for the recovery and development of the economy. Coal meets over 70% of commercial energy demand, and this situation will not change greatly up to the year 2000 which means that, for an assumed energy demand in the year 2000 of about 1.13 to 1.2 billion tones coal equivalent, today's coal extraction will have to be doubled. This thesis gives a thorough description of the situation, prospects, and problems of Chinese coal mining. In connection with the transferability of German mining techniques and mechanization processes to Chinese mining, the following subjects are furthermore discussed in detail: experiences with the mechanization of coal production in German black coal mining and possibilities to make use of them in Chinese mining, mechanization of tunneling, and proposals for better solution of remaining problems such as how to frame effective statistics on coal production, coal-price regulation, safety at work in the pit, improvement of the infrastructure, and extension of processing capacities. (MOS).

44613 (NP—8770342) **Model experiments to develop roadway supports in deep black-coal mining. Improvement of experimental technique, adaptation to measuring results underground, solution of rock-mechanical and support-technological problems.** Fielitz, F.F. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Bergbau und Geowissenschaften). 12 Dec 1985. 216p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770342/JAW.

Essential topics of this thesis are: modelling technique using equivalent materials, evaluation of experiments according to their qualitative and quantitative use and, in this connection, the transfer-

ability of results to conditions underground. Furthermore, the areas where model experiments are useful and their limits are discussed. The work comprises the following individual topics: modelling technique using equivalent materials, results from over 20 years of research conducted by the Forschungsstelle for Mine Supports and Rock Mechanics, critical investigations in relation to the model experiments, experiments on how to adapt model experiments more closely to observations underground, and model experiments to solve particular rock-mechanical and support-technological problems. Thus, the thesis studies roadway models with varying pressure distribution on the marginal surfaces. They permitted to investigate the influence of pressure and changes of pressure on roadway convergence. This gave rise to a multitude of questions on pressure-and-deformation relationships in rock, which are important both underground and for the model experiment on the dimensioning of supports and should be solved by further model experiments. (MOS).

44614 **(PB—88-197975/XAB) Realisation of a practical inspirable dust spectrometer. Technical memo. (Final).** Vincent, J.H.; Mark, D.; Botham, R.A.; Lynch, G.; Aitken, R.J. (Institute of Occupational Medicine, Edinburgh (UK)). Dec 1987. 94p. (TM—87/07). NTIS, PC E06/MF E06.

The project set out to develop new instrumentation for dust measurement in mines upon which to base a better understanding of the factors leading to disease and, in turn, improved standards setting and environmental conditions. The resulting static inspirable dust spectrometer is an eight-stage cascade impactor based on the principle of rectangular jets impinging onto rotating drums. It incorporates an entry that aspirates the inspirable fraction of the ambient airborne dust. Thus it can provide the particle aerodynamic size distribution of the inspirable fraction and so enable determination of the particle size distributions and airborne mass concentrations of any subfraction relevant to health (e.g., thoracic, respirable). It can also provide aerodynamically-classified dust samples suitable for mineralogical analysis. As a result of the rotating-drum feature, such information may be obtained for time increments within individual working shifts. The instrument is a static sampler, intended for fixed-point operation.

44615 **(PB—88-198494/XAB) Respiratory infections in coal miners exposed to nitrogen oxides. Technical memo. (Final).** Jacobsen, M.; Smith, T.A.; Hurley, J.F.; Robertson, A.; Roscrow, R. (Institute of Occupational Medicine, Edinburgh (UK)). Sep 1987. 126p. (TM—87/14). NTIS, PC E07/MF E07.

Coal miners working underground may be exposed chronically to low levels of nitric oxide (NO) and nitrogen dioxide (NO_2) from diesel engine emissions and from the use of explosives for blasting. The aims of the study were to establish whether long-term exposures to low concentrations of these gases at nine British coal mines had been associated with increased susceptibility to respiratory infections, and if so, to estimate relative risks for different levels of exposure. The range of concentrations of nitrogen oxides to which the miners had been exposed occupationally were similar to those recorded in some cities polluted by motor-vehicle exhaust emissions. The results suggest that similar concentrations of these gases in urban environments are unlikely to cause complaints in manual workers that would be diagnosed by family doctors as respiratory infections.

44616 **(PB—88-209325/XAB) Personal equipment for low-seam coal miners. 9. Development and testing of knit-fabric gloves. Open File report (Final) 1982-1985.** Sanders, M.S.; Krohn, G.S.; Downing, J.V.; Shaw, B.E. (Essex Corp., Westlake Village, CA (USA). Human Factors and Training Systems Group). Dec 1985. 61p. NTIS, PC A04/MF A01.

See also PB—83-218594, and PB—88-209333.

This report discusses the development and testing of prototype gloves for underground-mining work. An analysis of HSAC hand-finger injuries revealed three high-risk jobs: laborer; mechanic; and roof bolter. Laboratory tests of dexterity and protection were performed using six off-the-shelf gloves. Two prototype gloves were developed. Both were Kevlar-cotton blend knit gloves. Field tests revealed that the solid-coated gloves were preferred by workers, but that the polyvinyl melted when working with hot drill steels.

44617 **(PB—88-209333/XAB) Personal equipment for low seam-coal miners. 10. Improved knee pads, a modified design. Open file report (Final) 1982-1986.** Sanders, M.S.; Shaw, B.E. (Essex Corp., Westlake Village, CA (USA). Human Factors and Training Systems Group). Mar 1986. 22p. NTIS, PC A03/MF A01.

See also PB—83-218594.

The purpose of the work was to develop and field test improved knee protection for underground coal miners working in low-seam mines. In a previous phase of this contract (Sanders, 1982), experimental knee pads were developed and field tested. The work summarized in this report, therefore, consists of modifying the design and method of fabrication of the knee pads originally described by Sanders (1982), and of field testing the improved design. The new prototype was shorter and wider than the original design, and used a neoprene pass-through strap design rather than a cloth strap molded into the pad itself. The new prototype was constructed by slush molding a hollow bladder that was then filled with foam.

44618 **(STEV-TORV—88-7) Combination systems with milled and sod peat. 1987 stage 2.** Jonsson, E.; Teljing, Aa. (Statens Energiverk, Stockholm (Sweden)). Jan 1988. 53p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753726/JAW.

A simulated comparison on a theoretical basis with a milled peat oriented combination system has been carried out. The result of this years study has been calculated from a price level of 85 SEK/MWh in the stock pile at the bog. With this background the following conclusions can be made: 1. The test results show, respectively indicate, that both a tested sod peat oriented combination system and a simulated milled peat oriented combination system gives a higher positive margin than conventional milled peat production and conventional sod peat production. 2. From a practical production point of view a sod peat oriented combination system has the advantage that the milled peat can be harvested in a short period of time usually covered by weather forecasts for this time period. From a theoretical point of view the simulated results from the milled peat oriented combination system shows a higher total margin per hectare than the practical test results from the sod peat system. 3. For the producers a combination system always gives a positive margin. /sup B/reak-even/sup /is reached for a sod peat oriented combination system at an investment level of 600000 SEK in milled peat equipment at 20 hectares production area. The corresponding theoretical /sup b/reak-even-point/sup /for a simulated milled peat oriented combination system is 50 hectares if 1.200.000 SEK has to be invested in sod peat equipment. Both combination systems give a substantial positive margin on most of today's peat production areas if both types of peat can be sold to the price level stated above. (authors).

44619 **(STEV-TORV—88-9) Studies of the depth and duration of ground frost of peat production areas in Sweden and Finland.** Dryler, K.; Frilander, P.; Niittylae, H.; Leinonen, A. (Statens Energiverk, Stockholm (Sweden)). Mar 1988. 98p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753728/JAW.

A careful registration of the depth of the ground frost, snow, water level, and soil temperature, was done during the winter 1985/86, at eight different peat production areas in Sweden. At one of the places, Traeskmyran, a larger registration was carried out, with eleven spots totally. Experiments to influence the thawing speed of the ground frost at peat production areas by melting the snow by different means, was carried out at three peat production areas during the spring 1986. The different materials used were iron oxide, soot and milled peat. The measurements on the test areas indicate that: -the largest part of the ground frost was thawing from the top, -the thawing of ground frost was negligible from the bottom, -the depth of ground frost is dependent on temperature and the depth of snow, -the ground frost can differ more across a strip than along or among different strips, -high groundwater level gives a small decrease of the ground frost depth, -thawing of soil frost, underneath 20 cm of the surface, occurs faster on an area with high

groundwater level than an area with low groundwater level, - forced snow melting did not effect the thawing of the ground frost 20 cm below the surface, during the test year. (authors).

0130 Transport And Handling

REFER ALSO TO CITATION(S) 44628, 44629

0140 Combustion

REFER ALSO TO CITATION(S) 44546, 44547, 44555, 45532, 45751

44620 (DOE/PC/79909—1) Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, September 15, 1987-December 15, 1987. Akan-Etuk, A.; Niksa, S.; Kruger, C.H. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Mar 1988. Contract FG22-87PC79909. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013729/JAW.

During the period September 15, 1987 through December 15, 1987 we began to define the design specifications for representative sampling of particulates in our one-dimensional coal flow reactor. Factors important to both the pyrite thermochemistry studies and the fragmentation studies were identified. An examination of the established performance of the Stanford Coal Flow Reactor (SCFR) indicates that estimates of residence times must account for the flow disturbances due to shear on the fuel injector. This factor is important in the pyrite thermochemistry studies, since transient conversion is monitored. In the fragmentation studies, however, only the extent of burnoff is pertinent and, provided that the sampling probe is mounted near the reactor outlet, the suction velocities for isokinetic sampling can be based reliably on the nominal plug-flow velocity. The feasible domain of operating conditions for the fragmentation studies is developed from three independent considerations: the stability of the arc jet gas preheater, the combustion times to realize high levels of burnoff, and the available residence time in the SCFR. An analysis which intersects these three constraints pinpoints particle sizes between 50 and 100 microns and gas flowrates and arc power settings which should yield fragmentation phenomena near the reactor outlet. Oxygen levels from 11 to 20 % and temperatures from 1450 to 1750 K lie within the domain of feasible operating conditions. 2 refs., 5 figs., 2 tabs.

44621 (DOE/PC/79913—T1) Aeroated atomization of coal-water slurries. Buckner, H.N.; Sojka, P.E.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). Thermal Science and Propulsion Lab.). 5 Jan 1988. Contract FG22-87PC79913. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013726/JAW.

The first phase of this project requires that a coal-water slurry (CWS) simulants be used in the experiments instead of a coal-water slurry since optical techniques will be incorporated to measure air bubble size and velocity. These optical measurements require that the simulants be translucent or transport and imitate the rheological characteristics of the CWS. Carboxy-Methyl-Cellulose (CMS) polyacrylamide and poly-ethylene-oxide show promise as simulants. Results on these simulants and descriptions of improvement to the test equipment are presented. (CBS)

44622 (DOE/PC/79913—T2) Aerated atomization of coal-water slurries: [Progress report]. Buckner, H.N.; Sojka, P.E.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). Thermal Science and Propulsion Lab.). 9 May 1988. Contract FG22-87PC79913. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013727/JAW.

In order to understand how the polymer solutions will behave in the test facility, a solution of polymer and water was mixed to achieve a relatively low viscosity (130 cp). When atomizing this fluid, excellent results in the annular flow regime were obtained. The Sauter mean diameter (SMD) was found to be 25 {mu}m at an air/liquid ratio by mass of 0.25. Sauter mean diameter asymptotically approached 15 {mu}m as the air/liquid ratio was increased to 2. However, atomization was not achieved in the bubbly flow regime. Since the viscosity of the polymer water solution mentioned above was significantly different from that of CWS, it was determined that pure glycerin, having a viscosity of 1300 cp and a surface tension of 64 dyne/cm, would better represent the viscous forces. A series of tests was run with this fluid, and excellent results were again obtained. Sauter mean diameter asymptotically approached 25 {mu}m as the air/liquid ratio was increased to 1.0. Good atomization was obtained even at low air/liquid ratios. SMD data are presented for atomization of pure glycerin. Again, no atomization was observed in the bubbly flow regime. Attention will now be focused on obtaining results using pure glycerin and glycerin water solutions. It is important to understand the effects of viscosity on both the SMD and the state of the flow. The current data do not allow any firm conclusions to be drawn and it will be necessary to repeat some of the experiments mentioned above in order to provide a clear picture. Additional solutions of less viscous mixtures of glycerin and water will also be tested in order to clarify the effects of changes in viscosity. 7 figs.

44623 (DOE/PC/79915—T2) Mechanisms of coal-water mixture combustion in fluidized beds: Technical progress report for the period December 15, 1987--March 15, 1988. Brown, R.C. (Iowa State Univ. of Science and Technology, Ames (USA)). 1988. Contract FG22-87PC79915. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013723/JAW.

Work on this research project has concentrated on completing the design and construction of experimental apparatus and instrumentation. We have also obtained additional coal samples and have formulated test plans for experiments to be performed. We have modified the combustor to improve reliability of start-up procedures. As in past experiments, the sand bed is preheated with LP-gas that is mixed with fluidization air in the plenum below the bed. However, we have installed electrodes above the bed that provides a continuous electrical ignition source during the preheat period. Tests have confirmed that this modification is effective in providing reliable combustor start-up. Two important changes have been made in gas and particle sampling from the combustor effluent compared to past projects. 10 refs.

44624 (IVA—310, pp 113-121) Fluidized bed research and development in Sweden. Leckner, B. (Chalmers Univ. of Technology, Goeteborg (Sweden)). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

The principal reasons for developing fluidized bed boilers are the fuel flexibility of the bed and the possibility to decrease harmful emissions, such as sulphur dioxide and nitrogen oxides. In different countries and at different times, different advantages of fluidized bed combustion are emphasized. At present, the environmental aspects dominate, and there is a vivid interest in knowing the capacity of the fluidized bed to reduce the emissions and to find the optimum design of fluidized bed boilers.

44625 (PB—88-208178/XAB) Effect of fuel sulfur on nitrogen oxide formation in combustion processes. Final report, January 1976-December 1980. Wendt, J.O.L.; Corley, T.L.; Morcomb, J.T. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). May 1988. 251p. NTIS, PC A12/MF A01.

This report gives results of research that focuses on the questions: is the sulfur content of a fuel likely to have a major influence on the resulting NOx emissions; and does the presence of fuel sulfur cause major changes in mechanisms of fuel NO formation. Research results will aid in the interpretation of data on effects of fuel quality and composition on pollutant formation and will help in the development of combustion modifications for pollutant control from burning dirty fuels. The most important conclusion is that the presence of fuel sulfur will increase the ultimate conversion of fuel nitrogen to NOx under poorly mixed flame conditions that are often typical of combustion modifications. The influence of sulfur is to increase the total amount of XN species (NO + NH3 + HCN) under rich conditions, and this effect is most pronounced at high temperatures. The mechanisms occur in the post-flame or at fairly

long residence times and probably involve interactions between the hydrocarbon chemistry, sulfur, and nitrogenous species.

44626 (STEV-TORV—88-8) Study of peat-fuel contaminated with radioactivity at Sandviken power plant. Sandstroem, T. (Statens Energiverk, Stockholm (Sweden)). Feb 1988. 32p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753727/JAW.

In this investigation, during 7-10 July 1986, the effects of radioactive fall-out of cesium-137 from the Chernobyl accident was studied. The investigation was made at a 30 MW peat burning power plant in Sandviken, in the middle of Sweden. High concentrations of cesium-137 in the surface of peat bogs, had been measured in this area. The sod peat used as fuel contained 1122 Bq cesium-137/kg dry matter in average during the three days. The concentration of cesium-137 in the combustion products was up to 20000 Bq/kg dry matter in particles which were found in the chimney. The fly ash which was the main combustion product contained up to 11000 Bq/kg dry matter, with an average of 9390 Bq/kg. In the investigation only 35% of cesium-137 in the sod peat could be recovered in the ash, most of it in the fly ash. On an additional investigation Dec 86 - Jan 87 a better balance between cesium-137 in the sod peat and in the ashes could be found. 87% of cesium was found in the combustion products, compared to the sod peat. The reason of this result is probably that it is necessary with a longer combustion period to get an equilibrium of cesium in the plant. The concentration of cesium-137 in the fly ash was now almost 20000 Bq/kg dry matter. The highest concentration could even now be found in the chimney, up to 70000 Bq/kg dry matter.

44627 Combustion of pulverized coal using waste carbon dioxide and oxygen. Wang, C.S.; Berry, G.F.; Chang, K.C.; Wolsky, A.M. (Energy and Environmental Systems Div., Argonne National Lab., Argonne, IL (US)). *Combustion and Flame;* 72: No. 3, 301-310(Jun 1988).

Combustion of pulverized coal in CO/sub 2//O/sub 2/ as well as in air atmospheres is studied. Predictions using a one-dimensional computer code were compared with actual experimental data from tests conducted by Battelle Columbus Laboratories. The comparison of predicted and measured data for all test cases show that the observed trends of distributions of temperature and of species concentrations are generally predictable. The study confirms that the combustion of pulverized coal can be completed in a CO/sub 2//O/sub /2 atmosphere over a range of CO/sub 2/-toO/sub 2/ mole ratios between 2.23 and 3.65.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 46199

44628 (NEDOJ—8601) Report of the survey on the possibility of USA coal price reduction (Part 1). (Japan Coal Development Co. Ltd., Tokyo). Jun 1986. 157p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754191/JAW.

2-year survey was made on the possibility of reducing the inland transportation cost in the western region coal of USA. Out of the railroad lines and pipe lines selected, the following two transportation routes were compared to prepare an economy comparison. (1) Bowder River, Wyoming to Portland, Oregon. (2) Price, Utah to Los Angeles, Long Beach. Economy assessment was made on i) railroad transportation ii) Pipe line transportation, iii) Comparison of the two systems. If various infra-structures are established, pipe line transportation has possibility of considerably reducing the inland transportation cost. But it is further necessary to make a detailed analysis on the comprehensive coal chain including the production site, ocean transportation, receiving equipment at the destination, and the analysis of various problems involved. (21 figs, 74 tabs)

44629 (NEDOJ—8602) Report of the survey on the possibility of U.S.A coal price reduction (Part 2). (Japan Coal Development Co. Ltd., Tokyo). Jun 1986. 356p. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88754192/JAW.

This is an integrated report of the survey by Fluor Asia Inc. at the request of Japan Coal Development Co., Ltd. for the purpose of studying the possibility of reducing the cost of U.S. inland transportation of coal exported to Japan. Survey was made on 6 railroad lines and 4 slurry pipe lines in U.S.A. Concerning the railroad transportation, detailed analysis is described not only on the examination on the effect of the Staggers Act and the comparison between the cost between the Canadian and the U.S. railroads, but on the railroad transported cargoes, cost, and production. Concerning the slurry pipe lines, detailed description on the respective pipe line, analysis of capital cost and the operating expenses, and on the system construction is made. In the last, an overall comparison of the railroad transportation and the pipe line transportation is made. (58 figs, 156 tabs, 10 maps)

44630 (NEDOJ—8703, pp 535-548) Study on expansion of coal flow in Pacific area. Hosaka, Komao. (New Energy Development Organization, Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This report presents results of a study on future trends in supply and demand of coal in Asian and Pacific areas and the needs and demands for international cooperation for coal flow in each country in the areas. The minimum expected exporting potential will remain smaller than imports in 1990, suggesting that the state of excessive supply will continue. In 1995, however, demands for imports will exceed the minimum expected exporting potential, making it necessary for Asian countries to expand their domestic coal supply, though the supply-demand relations of coke making coal will stay almost unchanged even in 1995. Thus only the import of ordinary coal is expected to remain as the major problem in the mid-1990s and succeeding years. Examination is also made on specific cooperation activities to be performed by each country in the fields of resources development, thermal power generation using coal, application techniques and information exchange. It is important to continue investigating the cooperation activities and needs in each country and to carry out a large-scale survey to determine the optimum coal flow. (3 figs, 6 tabs)

44631 Longwall mining: Financial risk analysis by microcomputer. Britton, S.G. (Tanoma Coal Co., Inc., Indiana, PA (US)). pp 77-86 of Longwall USA. Aurora, CO; Industrial Presentations West (1987). (CONF-8706263—).

From Longwall USA; Pittsburgh, PA, USA (2 Jun 1987).

Longwall mining has emerged as a leading underground method for producing coal in the United States. The financial analysis of longwall mining has always been subject to debate because of the high capital cost of the equipment, the lengthy development scheme used to support the system, and the long payback cycle of the system as a whole. These factors tend to discourage a detailed costing analysis because of the complexity of the problem, or will force a superficial analysis based on rough economic and mining parameters. A dilemma would come about as a company committed its limited resources to longwall mining without the full knowledge of the economic risk of its decision. A solution to this dilemma comes in the form of using computers to do the number-crunching for each operating scenario and market condition. The typical mining company can utilize the vast power of the computer within their supporting budgetary limitations. A particular software program called LOCOST is a spreadsheet created from Lotus 1-2-3. LOCOST is currently being tested by the author as a longwall financial analysis program to assess the longterm risk of using longwall for a particular property and reserve. The program can tailor the financial needs of the user to model the cashflow of the system over the life of the reserve. The end result is that a decision for using longwall in a particular area can be judged through a systematic approach to the economic risk of operating a longwall system versus using the rough guess approach so popular with mine managers.

0160 Health And Safety

REFER ALSO TO CITATION(S) 44615, 44616, 44617, 45822

44632 (PB—88-198510/XAB) Dust-related risks of radiological changes in coal miners over a 40-year working life: report on work commissioned by NIOSH, (National Institute of Occupational Safety and Health). Technical memo. Hurley, J.F.; Maclaren, W.M. (Institute of Occupational Medicine, Edinburgh (UK)). Dec 1987. 71p. (TM—87/09). NTIS, PC E06/MF E06.

This study provides estimates, using data from the National Coal Board in Britain, of the prevalence of simple pneumoconiosis and of progressive massive fibrosis (PMF) in coal miners at various stages of a 40-year working life. Data from 52,264 intervals at risk were used to estimate the probabilities of radiological changes over five-year periods, for various combinations of age, dust exposure, and carbon content of the coal, using logistic regression methods. The transfer to lower dust concentrations of men with simple pneumoconiosis had negligible effect on the estimated risks. Results reinforce the conclusion from other recent studies of PMF, that the limitation of dust exposures for all miners is the only reliable way of limiting PMF. The authors think that the concentration-specific estimates of long-term PMF risks described are the most reliable indices of their kind available to date.

44633 Safety evaluation of coal mine power systems. Collins, E.W. (Sandia National Labs., Albuquerque, NM (US)). pp 51-56 of 1987 proceedings annual reliability and maintainability symposium. Piscataway, NJ; IEEE Service Center (1987). (CONF-870104—).

From Annual reliability and maintainability symposium; Philadelphia, PA, USA (27 Jan 1987).

This paper documents the development and application of an analytical technique that identifies potential electrical hazards in existing coal mine power systems. Specifically, a safety evaluation technique is developed by integrating preliminary hazard analysis; operating hazard analysis; failure mode, effect and criticality analysis; fault tree analysis; and accident report analysis. This technique assists the analyst in identifying potential hazards in a system initiated by component failure and/or human error, qualitatively ranks the hazards based on accident data, and provides a valuable tool in evaluating design and/or procedural methods (countermeasures) to control or mitigate the effects of the hazards. Application of this technique to a representative model of a coal mine distribution power system identified six countermeasures that control or mitigate the effects of a majority of the electrical accidents used in the analysis. Also, the results indicated that human error and poor design of maintenance features of the equipment directly contributed more to accidents than component failures. However, component failures do result in increased exposure of maintenance personnel to electrical hazards present in the system.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 45111

44634 (CMI-R—872330-4) Choice of the level of detailing in reservoir modeling at an early stage field evaluation. Asheim, H.; Hallefjord, Aa. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Feb 1988. 28p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753687/JAW.

The choice of level of detailing should be made on the basis of the intention with the model and the available data, and not on the basis of available programs and computers. The report deals with suitable model simplifications at an early stage field evaluation. This gives some simple analytical and numerical models, which are presented. 12 refs., 2 figs.

44635 (LBL—24909) US energy vulnerability in the 1990s: A reassessment. Goldman, C.A.; Rothkopf, M.H.; Pantell, S.E.; Thorpe, A.B. (Lawrence Berkeley Lab., CA (USA)). Apr 1987. Contract AC03-76SF00098. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88014035/JAW.

This report focuses on the oil supply system because it is most vulnerable to supply disruptions with major consequences for national security. Oil has been described as the world's most important primary commodity, supplying about 40% of US total energy consumption, and an even larger share for our Allies (e.g., Japan, 56%; OECD, 42%). Oil is one of the most flexible and portable sources of energy; oil markets are global, interconnected, and integrated to a much greater extent than those of other fuels. Oil supply disruptions have occurred fairly frequently over the last 25 years and can have major economic impacts depending on the supply/demand balance, level of excess capacity, sharpness of the price response, the duration of the disruption, and the policy/political response of major oil consuming nations. Our economic vulnerability to oil supply interruptions is caused primarily by the great difficulty that the economy has in adjusting to large, unexpected increases in the price of oil. Sudden interruptions in oil supply can cause these price spikes because oil demand is very inelastic in the "short run" - large price increases are necessary to overcome small shortages. The economic losses come principally from macroeconomic adjustment problems (e.g., increased inflation, higher unemployment) as well as higher oil import bills. Low oil prices increases our dependence on low cost oil producers, principally the Persian Gulf countries. The increased share of world oil production from the Persian Gulf directly affects the level of damages that could potentially occur from a major interruption of supply from this volatile and unstable region. We also found that release of strategic reserves can substantially mitigate economic losses as government oil stockpiles can serve as temporary spare capacity during a supply disruption.

0202 Geology And Exploration

44636 (IKU-R—25.24033.00/01/87) SEMI - A program for the modeling of buoyancy driven, Secondary migration of oil and gas by means of a ray-tracing technique. Sylta, Oe. (Institutt for Kontinentalundersoekelser og Petroleumsteknologi A/S, Trondheim (Norway)). Mar 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753693/JAW.

A program for the modeling of buoancy driven, secondary migration of oil and gas in three dimensions is described. The migration modeling is based on a ray-tracing procedure and handles faults, pinchouts, salt domes, spill from traps and leaks. Retention of hydrocarbons in the carrier bed is modelled from its dependence on carrier bed permeability and dip as well as hydrocarbon viscosity, saturation and density. 4 refs., 23 figs., 2 tabs.

44637 (NP—8770228) Extraction of the subsurface structure and of geophysical parameters from marine measurements for the development of hydrocarbon resources. Final report. Schneider, J.; Knecht, M.; Ristow, D. (Prakla-Seismos G.m.b.H., Hannover (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1986. 116p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770228/JAW.

Two methods have been developed for the interpretation of the amplitudes of seismic measurements: a) Transformation to 'Zero Offset' followed by a True Amplitude correction (TAS-correction). b) Transformation to plane wave data for different dips of the generating waves. Developments according to a): a method for which for each reflector the TAS-correction is applied in the stacked section in a multiplicative fashion and a method for which the TAS-correction is achieved by summation in the stacked section over the diffraction curve of a point diffractor. According to b) the following methods for the plane wave decomposition have been developed: Slant-Stack method and Plane Wave Decomposition (PWD). (orig.) With 37 refs., 68 figs.

44638 (PB—88-208863/XAB) Geological and operational summary, Kodiak Shelf stratigraphic test wells, western Gulf of Alaska. Final report. Turner, R.F.; Lynch, M.B.; Conner, T.A.; Hallin, P.J.; Hoose, P.J. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Oct 1987. 340p. NTIS, PC A15.

Contents include: regional petroleum exploration history; operational summary of the Kodiak Shelf stratigraphic drilling program; lithologic summary; velocity analysis; seismic stratigraphy and tectonic evolution of the Kodiak Shelf; well-log interpretation; biostratigraphy; organic geochemistry; geothermal gradient; abnormal formation pressure; shallow geology and geologic hazards; and environmental considerations.

44639 (PB—88-212030/XAB) Outer Continental Shelf Environmental Assessment Program: comprehensive bibliography, January 1988. (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Jan 1988. 750p. NTIS, PC A99/MF E04.

See also PB—84-208008.

The bibliography lists reports from investigators of the Alaska Outer Continental Shelf Environmental Assessment Program. Some non-program documents are also included. More than 3600 entries are sorted by author and citation number. Cross-references are available by Alaska region, discipline and research unit number.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 45514

44640 (CMI-R—30152-1) Production uncertainty. Stensland, G.; Tjoestheim, D.B. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Feb 1988. 82p. (In Norwegian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753684/JAW.

To investigate if standard stochastic models can be adapted to oil production data, an analysis of data from a series of named oil fields have been made. It is shown that production data are, to some extents, encountered with very great uncertainty, but known stochastic models may be adapted to the data. The models are mainly of two types: Continuous models of the diffusion type, where analytic solutions can be found for accompanying decision problems, and discrete models which are more general, and perhaps more realistic, where solutions may be found numerically by means of dynamic programming. Further, it is indicated how an uncertain production discription by stochastic models, may be useful for a series of economic decision problems, which arise in planning and development of an oil field. 14 refs., 24 figs., 53 tabs.

44641 (IKU-R—08.2684.01/02/87) Simple phase behavior formulation for compositional reservoir simulators. Hustad, O.S. (Institutt for Kontinentalundersoekelser og Petroleumsteknologi A/S, Trondheim (Norway)). May 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753691/JAW.

The report is part of a project to review current phase behavior calculation methods and develop alternative formulation methods to describe phase behavior within the context of a compositional reservoir simulator. In this report a simplified phase behavior formulation is presented. A detailed description of a formulation for densities and equilibrium constants is given. The formulation may be applied to systems containing pure components and pseudocomponents. 8 refs., 14 figs.

44642 (IKU-R—08.2740.00/01/87) Improved displacement efficiency by gas injection - mobility control. A summary of the use of foam promoting additives. Holt, T. (Institutt for Kontinentalundersoekelser og Petroleumsteknologi A/S, Trondheim (Norway)). May 1987. 42p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753692/JAW.

Foam systems have several valuable properties that may be utilized is gas injection. Foam has a much higher apparent viscosity than its single constituents. The viscosity will increase with the permability of the porous material and decrease in regions with high oil saturation. This can make possible a gas injection with a favorable mobility rutio between desplacing and displaced fluids. At the same time, unfactorable effects, because of low densities of the gas, and effects of regions with high permability, can be reduced. Foam may also be used for blocking of regions with high permability. In a series of tests in field scale, use of foam promoters to improve the displacement efficiency has been successful, both technically and economically. The field tests have, however, been performed with systems, and under conditions, which are very different from those in the Norwegian regions. 51 refs., 2 figs.

44643 (NEI-NO—44) Underwater technology conference -86 - Deep water technology. Proceedings of the international conference, Bergen, Norway, April 14-16, 1986. Mellingen, T. (ed.). (Norges Skipsforskningsinstitutt, Trondheim). 1986. 573p. (CONF-860481—). NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW.

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This volume presents the proceedings of the fourth Underwater Technology Conference which was staged in Bergen (Norway). Since the third conference two years ago, subsea oil and gas exploitation has become a reality on the Norwegian offshore scene. The North-East Frigg field has been in production for more than two years and the subsea development of the Gullfaks and Oseberg is under realisation. Extensive subsea development studies and work including testing are now underway for several oil and gas fields. Increasing water depths, harsher weather conditions and greater uncertainty for future oil and gas prices, have all increased the necessity for subsea exploitation. By blending discussion of todata achievements and experiences with current thinking on tomorrow's challenges, the Underwater Technology Conferences seek to present a clear picture of the subsea scene. Separate abstracts are prepared for each paper.

44644 (NEI-NO—44, pp 15-31) Design of subsea control systems. Pettersen, B.; Godal, E. (Seanor Engineering A/S, Drammen (Norway); Servocon A/S, Oslo (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper discusses the design of subsea control systems, and presents methods for the dynamic analysis of hydraulic control systems by means of modern computer technology. The cases presented in the paper, are based on real life projects. When the hydraulics of a subsea X-mas tree is to be designed, the engineer usually starts selecting dimensions of a number of components and type of fluid. The problems begin fitting them all together to make sure that the system specifications are met and at the same time not overspecifying any single part. One of three lines must be followed: Estimate the performance based on experience with similar systems; carry full scale tests; model each component and carry out a somputer analysis of the total system. The technique used is still not widely known, but has demonstrated its efficiency and accuracy through a large number of simulation jobs in the last four years. 13 drawings.

44645 (NEI-NO—44, pp 59-76) Monitoring of subsea oil and gas production. Development and application of the lot system. Landet, H.; Thoresen, J. (Sentralinstitutt for Industriell Forskning, Oslo (Norway); Kongsberg Vaapenfabrikk, Kongsberg (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

A flexible, reliable and accurate underwater instrumentation and data acquisition system is under development. The objective is to enable better monitoring of subsea completed production systems for oil and gas. This will give advantages related to field development-, operational-, safety- and reservoir management aspects. The paper describes the development of the LOT Monitoring System, an how advantages are taken from the increased potentials and reliability offered by modern electronics. Presently a functioning and tested prototype of the system exists, having the ability to monitor

hydrocarbon pressures, temperatures and the continuous position of gate calves with good accuracy. The paper also describes how the Monitoring System can be used separately or in combination with a subsea electro-hydraulic control system, and how it may be applied to subsea X-mas trees, manifolds and other subsea equipment. It describes the potentials of the present system and how new sensor types considered to be desirable can be implemented in the future. An outline of the currently running extensive reliability growth and qualification programme for the Monitoring System is given. 11 drawings.

44646 (NEI-NO—44, pp 77-87) **Utrasonic flowmetering in subsea installations.** Mylvaganam, K.S.; Hammer, E.A. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

Monitoring of gas and oil and measuring their flow velocity in offshore installations are day to day problems encountered in offshore petroleum activities. Ultrasonic flowmetering can be employed in various, mostly single-phase systems for transport of oil or gas. Tests at CMI indicate that ultrasonic flowmetering can also be applied to monitor mud flow. Mud is a medium encountered in abundance in the process of offshore boring for oil and gas. Information on mud flow would give a good possibility to monitor the boring process itself. With reference to available offshore systems, the potential application of ultrasonic flowmetering to various flow monitoring measurements is discussed in this paper. Safety and security in Zone I offshore installations are of paramount importance. A brief description of research and development with safety and security in mind is also presented with specific reference to ultrasonic flowmetering. Finally, ultrasonic flowmetering systems are presented in the form of prognoses for possible applications in practical system layouts for offshore installations. 6 drawings.

44647 (NEI-NO—44, pp 113-133) **Designing subsea systems for remote intervention.** Hulls, K.; Bowring, M.; Cow, S. (Comex Houlder Diving Ltd., Aberdeen (UK); vetco Gray, Aberdeen (UK)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The growth in the use of ROVs for carrying out intervention tasks on subsea equipment has been limited by a failure to engineer the interface between the subsea system components and the ROV. In the past, subsea system components have generally been designed without consideration being given to the requirements for remote intervention. ROV tooling development has concentrated on complex but low-powered manipulators imitating the human arm. This paper discusses the philosophy of designing subsea components and system layouts for remote intervention and the ROV tooling/component interface for specific intervention tasks. General consideration is given to the tasks which could ultimately be designed for remote intervention and the development of remote tooling packages. A brief history of some previous intervention philosophies is also given. 8 drawings.

44648 (NEI-NO—44, pp 163-185) **Subsea completed wells as parts of a total field development.** Boge, M. (Norsk Hydro, Oslo). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper deals with the planned development of the Oseberg Field on the Norwegian continental shelf. The field will be developed partly by conventional platforms and partly by subsea completed wells. Subsea completed wells are planned to be included in the Oseberg Field Development to provide faster build-up of production access to areas of the reservoir outside the reach of the platforms, and a reduction in overall investment. Twentyone subsea wells were planned for in the Field Development Plan. Based on a later Subsea Review Study this number was reduced to ten wells by increasing the deviation angle and the platform drilling reach, thereby changing some subsea wells to platform wells. Five of the subsea wells are producers, and five are for water injection. The wells will be developed partly as satellite wells and partly as clusters. They will be connected back to the platforms by flowlines and control cables. Control of the subsea wells will be by electrohydraulic control system. 14 drawings.

44649 (NEI-NO—44, pp 187-209) **Subsea completed wells as parts of a total field development.** Granaas, An. (Statoil, Stavanger (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper deals with the Gullfaks A Subsea Production System on the Norwegian continental shelf. The reservoirs in the Gullfaks field are heavily faulted with a main north-south fault separating the field into two parts. The original field development plans as approved by the Government in 1981 allowed the total field development in two separate phases. Phase 1, comprises the reservoirs to the west of the main fault and Phase 2, comprises the reservoirs to the east of the fault. As a result of the governmental approval for Phase 2 last year, the total Gullfaks field development plan has now become a continuous development plan through the Gullfaks A, B and C projects. The aim of the paper is to discuss the philosophy, development plan, technical and functional descriptions, and the experiences to date concerning the production systems of the field. 13 drawings.

44650 (NEI-NO—44, pp 211-223) **Factors affecting the layout of subsea development.** Kieft, T.G.; Goreham, C.D. (Pell Frischmann Engineering Ltd, London (GB)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The successful development of offshore oil or gas reservoirs can be measured in terms of production efficiency and return on capital investment. In the case of a subsea development the reliability of the components used, together with the flexibility of the design to overcome unit failures and minimise risks, contribute significantly to a successful project. The objective of this paper is to identify some of the primary factors to be considered in the development of a safe, reliable and economic subsea project. Practical experience gained during the conceptual evaluation and detailed engineering design of various North Sea subsea development has been used in preparation of the paper. 3 drawings, 1 table.

44651 (NEI-NO—44, pp 243-275) **Subsea manifolds for the Balmoral Field.** Adam, L.J.; Lacey, W.J.; Donovan, J. (Vetco Grey, Aberdeen (GB); North Seas Sun Oil Ltd.). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper describes the initial concept, design, manufacture and installation of 3 task specific manifolds for a marginal field development on North Sea Sun Oil's UK sector block 21A, the Balmoral Field. It describes how the Balmoral project is the first North Sea development to use a purpose built floating production vessel. In addition the system incorporates extensive use of flexible risers and a 14 slot integrated template with the production from both template and satellite subsea completions commingled subsea using remotely controlled subsea chokes. The 3 subsea manifolds located on the template provide central control of satellite well production, satellite water injection and template riser isolation. The paper shows that the manifold design philosophies which were adopted were based on the overall field development concept which was to use proven, cost effective equipment and diver assisted installation and maintenance. Aspects of the detailed process are discussed. In particular the paper describes how Computer Aided Design (CAD) systems offered major advantages in design and assembly planning. The use of CAD also permitted simulation of future manifold reconfiguration subsea to permit changeover to gas lift operations. The need to achieve a high level of dimensional accuracy during manufacture is highlighted and the techniques adopted to achieve this, including the use of jigs prepared by the template fabricator, are described. The paper reviews the subsequent successful field, installation phase and outlines the planned integration of the manifolds with the subsea control system. 15 drawings.

44652 (NEI-NO—44, pp 323-334) **Subsea production prototype development for deep water applications.** Weibye, B; Varvin, K. (Norsk Hydro, Oslo). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper presents general goals and preliminary results from a prototype and testing program for the next generation of deepwater subsea production systems, in the following main areas: Transportation pipeline pull-in/connection and pig launching systems for multiwell manifolded diverless gas production systems; Inductive and conductive subsea electrical connectors; control system pilot valves and hydraulic fluids; Subsea electric power generation; monitoring of sand particles in gas flow; too' for remotely operated vehicles; pipeline insulation materials; corrosion inhibition and material selection for transporation of unprocessed hydrocarbons. 5 drawings.

44653 **(RF/PRC/RT—5/86) Contents and micro-spatial distribution of clay minerals in sandstone reservoirs.** Bjoerkum, P.A. (Rogalandsforskning, Stavanger (Norway)). Jan 1986. 38p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753717/JAW.

The report describes the most common clay minerals in sandstone reservoirs on the Norwegian continental shelf. Various theories are discussed of how the clay survey is given of the importance of the clay minerals in respect of water injection, chemical and surfactant flooding. 37 refs., 3 figs.

44654 **(SI-R—870144-1) Requirements to data systems on mobile platforms in emergency situations.** Augland, D.; Larsen, C.T.; Nilssen, J.; Wilthil, V. (Senter for Industriforskning, Oslo (Norway)). Oct 1987. 76p. (In Norwegian). NTIS (US Sales Only), PC A05. Order Number DE88753669/JAW.

The purpose is to formulate a basic safety philosophy of requirements to data systems for control of important functions on mobile platforms and ships. Special considerations shall be devoted to operation in emergency situations to prevent incorrect decisions. The tasks include systems for propulsion machinery, dynamic positioning, ballasting procedures, drilling operations etc. This specific project will deal with ballasting procedures as an example. Based on this example, proposals of requirements to general test procedures for such systems, and requirements to a training plan for operators, will be obtained. 10 refs., 5 figs.

44655 **Laboratory setup to study two-dimensional multiphase flow in porous media.** Schiegg, H.O.; McBride, J.F. (Pacific Northwest Lab., Richland, WA (US)). pp 371-395 of Proceedings of the NWWA/API conference on petroleum hydrocarbons and organic chemicals in ground water: Prevention, detection and restoration. Dublin, OH; National Water Well Assoc. (1987). (CONF-871181—).

From NWWA/API conference on petroleum hydrocarbons and organic chemicals in ground water: prevention, detection and restoration; Houston, TX, USA (17 Nov 1987).

The paramount objective in developing the laboratory setup to study two-dimensional multiphase flow was to ensure that the quality of the data collected was not compromised by any failure to minimize the experimental error contributed by the laboratory setup through instrument systems and construction materials. To accomplish this objective, specific tolerances for maximum experimental error were delineated at the outset and adhered to. By minimizing experimental error, the data obtained from a series of oil propagation experiments performed in the flume are suitable for the preliminary validation of multiphase flow codes. The effort to stay within the maximum experimental error yielded a laboratory setup whose specifications are a direct product of the 0.33-mm mean grain diameter quartz sand used. Thus, if experiments were performed with different porous media, the specifications of the laboratory setup could change markedly. For example, the specifications needed to meet the same tolerated maximum field saturation measurement error could change to a degree that would exclude the dual-energy gamma attenuation method to nondestructively measure fluid saturation because a 15-cm cross-sectional width was determined to be near the maximum width for this method. In addition, other porous media, especially those with wider grain size distributions than the quartz sand, would probably not pack as homogeneously as the quartz sand. This problem is expected because the quartz sand was selected for its uniform grain size to pack homogeneously, and yet, obtaining a homogenous and isotropic fill was an important experimental problem.

44656 **A new method for determining fluid flow paths during hydraulic fracturing.** Fehler, M. (Los Alamos National Lab. (US)). pp 86-88 of Proceedings of the 57th annual international SEG meeting: Expanded abstracts with biographies. Tulsa, OK; Society of Exploration Geophysicists (SEG) (1987). (CONF-871012—).

From 57. annual international meeting and exposition of the Society of Exploration Geophysicists; New Orleans, LA, USA (11 Oct 1987).

Technical Paper ENG 1.5.

Although hydraulic fracturing is a popular method for increasing the productivity of oil and gas wells, there is no direct way other than drilling additional boreholes to determine where the injected fluid has gone and thus what direction a fracture has propagated. Information about fluid flow paths is important for designing subsequent fracturing operations for nearby wells. Determining the locations and orientations of permeable fractures is also important in studies of potential toxic waste repositories where it is critical to understand fluid flow paths. The authors developed a method for determining the orientations and locations of fractures along which fluid flows during hydraulic fracturing. The method is based on accurate determination of the locations of microseismic events, or microearthquakes, that accompany the hydraulic injection. By applying a pattern recognition technique to the locations of events from one hydraulic fracturing operation they find planes in the data along which the authors presume that the fluid has traveled. The planes determined using our method intersect the injection borehole and a second, nearby borehole, in regions where other data indicate that fractures are present.

0204 Processing

REFER ALSO TO CITATION(S) 44570, 45233

0205 Products And By-products

REFER ALSO TO CITATION(S) 45277

44657 **(AD-A—192244/2/XAB) Development of a test method to determine potential peroxide content in turbine fuels. Part 2. Interim report, September 1985-May 1987.** Fodor, G.E.; Naegeli, D.W.; Kohl, K.B.; Cuellar, J.P. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Jun 1987. 32p. (BFLRF—243). NTIS, PC A03/MF A01.

See also report dated 1 Jun 85, AD-A163 590.

Through the generally accepted 43 and 65 C bottle-storage method of accelerated aging, the relative ratings of six selected fuels' oxidative tendencies were established. In the 43 C test, storage for about 12 weeks produces results that are comparable to a full year's storage under ambient conditions. To develop a practical test method for the prediction of peroxide potential of fuels, experimental conditions were sought so that the oxidative tendencies of fuels could be assessed within a reasonable time. Accordingly, a matrix of experiments was designed to allow selection of reaction conditionally, the results of experiments should allow the development of global reaction kinetics to aid the determination of fuel peroxidation potential and to shed light on the reaction mechanism. The oxidations were carried out in a stirred pressurized reactor at 60, 80, 100, and 120 C, under oxygen pressures of 240, 790, or 1140 kPa (abs) for periods of up to 70 hours.

44658 **(AD-A—192743/3/XAB) Biodegradation of JP-5 aviation fuel by subsurface microbial communities. Progress report, 1 January-15 March 1987.** Swindoll, C.M. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). 1988. 17p. NTIS, PC A03/MF A01.

Leakage of the aviation fuels JP-5, JP-4 and AVGAS from storage tanks has resulted in a severe environmental insult to a Naval fuel farm and adjacent areas. As part of the reclamation effort, the indigenous microorganisms are being characterized. This information will be used to optimize the bioreclamation of the site. Approximately 60 aerobic microorganisms, including more than 40 bacteria, 6 actinomycetes and 10 fungi have been isolated from soil contaminated with aviation fuels and adjacent noncontaminated with aviation fuels and adjacent noncontaminated soil. All isolated bacteria were able to grow on JP-5 as their sole carbon source. Most of the bacteria from the contaminated sites were small, gram-negative rods, while most bacteria from the noncontaminated site were gram-positive rods. All of these microorganisms would be expected to contribute to the bioremediation of the contaminated site.

44659 **(PB—88-866017/XAB) Antioxidants and stabilizers for lubricants and fuels. January 1970-June 1988 (citations from the NTIS data base). Report for January 1970-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 99p. NTIS PC N01/MF N01.

Supersedes PB—87-863403.

This bibliography contains citations concerning antioxidants and stabilizing additives for lubricants, oils, and fuels, including jet engine fuels and mineral oils. The synthesis, properties, and thermal and storage stabilities of these additives are considered. (This updated bibliography contains 158 citations, 20 of which are new entries to the previous edition.)

0206 Health And Safety

REFER ALSO TO CITATION(S) 44643, 44644, 44645, 44646, 44647, 44654, 45515, 45569, 45570, 45571, 45572, 45574

44660 (NEI-NO—44, pp 463-475) **Are subsea wells safe?.** Addison, G.D.; Pinches, D.B. (Lothian Oil Consultants, Edinburg (UK)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper is concerned with well control and well killing activities of production wells, particularly subsea production wells. It addresses the problems associated with the making safe of a well in the event of failure or mechanical damage to downhole equipment. It does no discuss the condition when a catastrophic blowout has developed. The authors have made a study of the barrier concept and how barriers are created in a well. These are discussed and areas where current practice is inadequate are highlighted and additional safety measures proposed. In particular, the practice of closing subsurface safety valves (and Christmas tree valves in the case of subsea wells) across a column of kill fluid can, under certain circumstances, negate the effectiveness of the barrier. For subsea wells the weight of kill fluid to be used depends on whether the well should be dead, a) to the sea bed, b) to the sea bed allowing for the hydrostatic pressure due to water depth, or c) to the drill floor of the supporting platform. The relative merits of each method are discussed with regard to the operational problems in achieving them and the overpressures created on the formation. A comparison in also made with current floating drilling practice. In the light of the developing view in Norway that a workover rig should not intervene over a live well it becomes clear that most subsea wells cannot be adequately killed for intervention. An example is given to demonstrate this. 3 drawings.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 45131, 46199

44661 **(DOE/EIA—0380(88/04)) Petroleum marketing monthly, April 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 6 Jul 1988. 172p. NTIS, PC A08/MF A01 - GPO; GPO Dep. Order Number DE88013605/JAW.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs., 53 tabs.

44662 (NEI-NO—44, pp 337-350) **Production phase, a job for company or contrator?.** Larsen, B. (Odfjell Drilling and Consulting Company A/S, Bergen (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper examines the advantages of using a production contractor to carry out the production operations, especially on floating production units. There are very few production units operated by a production contractor today, but some of the fields that may be developed shortly in the Norwegian sector are discussed. The future floating production facilities where stability and deck load requirements are the main objectives are looked into. A concrete floating production unit is mentioned. The production contractor will base his costs and income on a somewhat different principle than the Company. The breakeven cost per barrel of oil produced concept is introduced. Finally, the paper looks to the various category of oil companies that may have a demand for a production contractor. 5 drawings.

44663 **Assessment of U.S. oil import tariffs and industrial competition in a multi-regional world model.** Hanson, D.A. (Policy and Economic Analysis Group, Energy and Environmental Systems Div., Argonne National Lab., Argonne, IL (US)). pp 205-214 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

Here it is shown that the monopsony or "demand" effect on the world oil price may be so significant that it may be in the U.S. economic interest to encourage (and co-fund) international energy cooperative programs. If an oil import tariff were implemented, tradeoffs would exist between reduction in the federal deficit and industrial competitiveness.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 44638, 44639, 44658, 45663, 45687, 45688

44664 **(AD-A—192486/9/XAB) Hydrocarbon-fuel-spill dispersion on water: literature review. Interim report, May-September 1986.** Edgerton, S.A.; Coutant, R.W. (Battelle Columbus Labs., OH (USA)). Dec 1987. 96p. NTIS, PC A05/MF A01.

The literature concerning the fate of light-hydrocarbon-fuel spills on water is reviewed. The review focuses on jet fuels and contains some discussion of gasoline, diesel, marine, and kerosene fuel spills. The two major fates of light-hydrocarbon spill on water are evaporation and dissolution, although biodegradation, photooxidation, and adsorption onto suspended sediments can also be of some importance.

44665 **(PB—88-198726/XAB) Fate of crude oil at sea and the natural dispersion of crude oils and water-in-oil emulsions: results of experiments using a laboratory test tank and free-floating rings at sea.** Lynch, B.W.J. (Warren Spring Lab., Stevenage (UK)). Jan 1987. 81p. (LR—598(OP)M). NTIS, PC E06/MF E06.

The behavior of a number of crude oils has been examined to determine the factors affecting their subsequent dissipation from the surface when spilt at sea. The effect of parameters such as initial oil-film thickness, water temperature, and asphaltene content of the parent crude oil upon emulsion formation and natural dispersion rates was examined. The results obtained at sea have indicated that the rates of viscosity increase, due to emulsion formation, and the measured initial dispersion rates of the oils tested can be related to their asphaltene contents. Laboratory results have shown that over the range of water temperatures used, 5, 10 and 20 C, indications are that the lower water temperatures enhance the rate of emulsion formation and reduce the rate of initial dispersion by increasing the initial rate at which the viscosity rises during emulsion formation.

44666 **Cumulative impacts of oil fields on northern Alaska landscapes.** Walker, D.A.; Webber, P.J.; Binnian, E.F.; Everett, K.R.; Lederer, N.D.; Nordstrand, E.A.; Walker, M.D. (Univ. of Colorado, Boulder, (USA)). *Science (Washington, D.C.);* **238**: 757-761(6 Nov 1987). Contract AI06-84RL10584.

Proposed further developments on Alaska's Arctic Coastal Plain raise questions about cumulative effects on arctic tundra ecosystems of development of multiple large oil fields. Maps of historical changes to the Prudhoe Bay Oil field show indirect impacts can lag behind planned developments by many years and the total area eventually disturbed can greatly exceed the planned area of construction. For example, in the wettest parts of the oil field (flat thaw-lake plains), flooding and thermokarst covered more than twice the area directly affected by roads and other construction activities. Protecting critical wildlife habitat is the central issue for cumulative impact analysis in northern Alaska. Comprehensive landscape planning with the use of geographic information system technology and detailed geobotanical maps can help identify and protect areas of high wildlife use.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 44652

44667 **(CMI-R—862346-1) Cost allocation by coordinated transport of petroleum. A literature survey.** Nilssen, T. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Sep 1986. 78p. (In Norwegian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753686/JAW.

The report gives a review of solution concepts in cooperative game theory. The solution concepts are characterized and compared in relation to desireable properties by methods for cost allocation. In particular, emphasis is put on the theory for cost allocations in networks. Finally, some practical questions are presented with an application of coordinated transport of oil and gas. 116 refs., 5 figs.

44668 (EPRI/EA/EL—5612, pp 2.16-2.19) **Destruction and salvage of large PCB transformers to end owner liability.** Graham, F.J.; Martin, W.H. (UNISON Transformer Services, Inc., Charlotte, NC (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Disposal of replaced transformers has long presented the owner with a dilemma. Current EPA regulations allow for landfill of PCB transformers in TSCA landfills, but only after draining and an 18-hour rinse. Although landfill is authorized, this disposal method is not without substantial potential for long-term liability. The carcass can still contain up to 2% of its name plate volume (20 to 100 lbs) soaked within its internals and the original owner remains responsible, jointly and severally, under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA or Superfund). Owners may attempt, by contractual means, to receive indemnifications from, or transfer title to, persons who have arranged for such disposal. Contractual indemnifications, title transfer, and legal disposal are not allowable defenses in Superfund actions and will not prevent the original owner from being held liable. 1 table.

44669 **(IFE/KR/E—831002) Slug flow in vertical, horizontal and inclined pipes.** Malnes, D. (Institute for Energy Technology, Kjeller (Norway)). Aug 1987. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753668/JAW.

The report deals with slug flow, characterized by large bubbles which nearly fill the channel. This is an important flow regime in oil/gas transport systems, where pipe layouts may vary from horisontal through inclined to vertical, in upflow as well as downflow. The main items are: The physical mechanisms of slug flow are reviewed and discussed; Procedures for the calculation of bubble velocities in stagnant liquids for inclined pipes are proposed, and tension effects are included; A general correlation for all pipe inclinations is proposed; Pressure drop calculations are reviewed and slug lengths discussed; A physical correlation for void fractions in liquid slugs is proposed. 24 refs., 14 figs.

0240 Storage

REFER ALSO TO CITATION(S) 44658

0250 Combustion

REFER ALSO TO CITATION(S) 44625

44670 **Analysis of fuel-lean combustion using chemical mechanisms.** Garo, A.; Westmoreland, P.R.; Howard, J.B.; Longwell, J.P. (Dept. of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA (US)). *Combustion and Flame;* **72**: No. 3, 271-286(Jun 1988).

Detailed fuel-lean C/sub 2/H/sub 2//O/sub 2/ flame data were used to explore the implications of published reaction sets. The data had been obtained using molecular-beam mass spectrometry in a flat flame at a fuel equivalence ratio of 0.12, pressure of 5.34 kPa, and cold gas velocity of 50.5 cm/s. Stable-species and free-radical mole fractions were predicted using a standard one-dimensional flame model and were tested against the data, similarly to our recently reported study of the same mechanisms under fuel-rich conditions. Mechanisms were derived from reactions sets reported by others. Successful predictions by the first two mechanisms were dominated by O-atom destruction of C/sub 2/H/sub 2/ to form CH/sub 2/ and CO and by CH/sub 2/ + O/sub 2/ → CO/sub 2/ + 2H, which destroyed CH/sub 2/ and rapidly produced the necessary "prompt CPO/sub 2/" and H-atoms. Although CH/sub 2/ predictions deviate significantly from the data, new insights into the experimental method show that the CH/sub 2/ data themselves were mistaken. More seriously, recent studies of C/sub 2/H/sub 2/ + O kinetics show that H + HCCO is the dominant product channel rather than triplet /sup 3/CH/sub 2/ + CO, which implies that singlet /sup 1/CH/sub 2/ may be produced quite rapidly in C/sub 2/H/sub 2/ flames from the reaction H + HCCO → /sup 1/CH/sub 2/ + CO. As a consequence, the distinctly different kinetics of ground-state /sup 3/CH/sub 2/ and electronically excited /sup 1/CH/sub 2/ should be distinguished explicitly in new combustion mechanisms.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 44591, 44860, 45694

0301 Reserves

REFER ALSO TO CITATION(S) 44634, 45111

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 44636, 44639

44671 (NEI-NO—44, pp 451-462) **Two years operational experience in subsea production system.** Gil, N.S.; Rensvik, H. (Elf Aquitaine Norge A/S, Stavanger (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

North East Frigg was one of the first multiwell subsea gas production systems in the world and represented an achievement in the subsea production technology. This paper concentrates on the experience gained from inspection, maintenance and repair of the subsea production system after start up in 83/84, and will give a brief description of: North East Frigg Field; description and definition of inspection principles and different systems used for underwater inspection; technical problems and repair on subsea production systems such as leaking couplings, swelling and leaking flexible lines. The papers intention is to give those involved with subsea production systems input in problems likely to arise during the production phase of a subsea field. 5 drawings.

44672 (SAND—88-1008) **Multiwell Experiment final report: 2, The paludal interval of the Mesaverde Formation.** (Sandia National Labs., Albuquerque, NM (USA); CER Corp., Las Vegas, NV (USA)). May 1988. Contract AC04-76DP00789. 551p. NTIS, PC 18; 1; GPO Dep. Order Number DE88012442/JAW.

The Department of Energy's Multiwell Experiment (MWX) is a field laboratory in the Piceance Basin of Colorado which has two overall objectives: to characterize the low permeability gas reservoirs in the Mesaverde Formation and to develop technology for their production. Different depositional environments have created distinctly different reservoirs in the Mesaverde, and MWX has addressed each of these in turn. This report presents a comprehensive summary of results from the paludal interval which lies between 6600 ft and 7450 ft at the MWX site. The interval is a complex, lower delta plain, fluvial depositional environment consisting of interbedded sandstone channels, carbonaceous siltstones and mudstones, and coals. Separate sections of this report are background and summary; site descriptions and operations; geology; log analysis; core analysis; in situ stress; well testing and analysis of one zone; well testing, stimulation, analysis and reservoir evaluation of another zone; supporting laboratory studies; hydraulic fracture diagnostics; and a bibliography. Additional detailed data, results, analyses, and data file references are given on microfiche in several appendices. Overall, the results show that the paludal is a complex and productive interval.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 44643, 44645, 44646, 44647, 44648, 44650, 44651, 44652, 44656, 44680

0304 Products And By-products

44673 (PB—88-216809/XAB) **Thermophysical properties of fluids for the gas industry. Annual report, January-December 1987.** Haynes, W.M.; Olien, N.A. (National Bureau of Standards, Boulder, CO (USA). Thermophysics Div.). Mar 1988. 284p. NTIS, PC A13/MF A01.

See also report for 1986, PB—87-218137.

Work carried out in the Fluid Properties Group, Thermophysics Division, National Bureau of Standards, Boulder, supported by the Gas Research Institute is reported. The most important results are: sound-speed data for mixtures of natural gas components, including Gulf Coast, Amarillo, Statoil dry gas, and binary mixtures of CO_2 with either CH_4 or N_2 and of CH_4 with C_3H_8 from 250 to 325 K at pressures to 10 MPa; fugacity data for H_2 + CO and H_2 + iC_4H_{10} mixtures; completion of Cv measurements for three mixtures of CH_4 + C_2H_6 from 100 to 320 K at pressures to 35 MPa; further development of a catalytic-cracking detector; and theoretical studies of sound-speed modeling using extended corresponding states and of a corrected mean density approximation for mixtures with large size ratios. The overall philosophy and technical resources of the group are discussed.

0305 Health And Safety

REFER ALSO TO CITATION(S) 44643, 44644, 44645, 44646, 44647, 44660, 44671, 44681, 45569, 45570, 45571, 45572, 45574

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 44662, 44930, 45132, 45269, 46199

44674 (DOE/EIA—0130(88/04)) **Natural gas monthly, April 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 7 Jul 1988. 151p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. Order Number DE88013040/JAW.

This report covers: dry gas production (wet marketed production minus extraction loss) during April 1988 was an estimated 1,333 billion cubic feet (Bcf), 0.2 percent below April 1987 dry gas production; consumption of natural gas during April 1988 was an estimated 1,369 Bcf, 1.2 percent below April 1987 level; the average wellhead price of natural gas in February 1988 was $1.82 per Mcf (thousand cubic feet). In February 1987, the average price $1.76 per Mcf; the average city-gate price for natural gas delivered to distribution service areas in March 1988 was $2.83 per Mcf, 2.8 percent below the March 1987 average; during the March 1987 billing cycle, residential consumers were billed an average of $5.19 per Mcf, commercial consumers $4.69 per Mcf, and industrial consumers $3.09 per Mcf; the residential average was down 3.5 percent, the commercial average was down 1.7 percent, and the industrial average up 5.5 percent compared to the March 1987 billing cycle; electric utilities paid an average of $2.55 per Mcf for gas purchased during February 1988, 5.8 percent above February 1987 average.

44675 (NP—8770249) **Gas rates 1988. As of January 1, 1988.** Schirrmacher, H. (comp.). (Bundesverband der Deutschen Gas- und Wasserwirtschaft e.V., Bonn (Germany, F.R.)). 1988. 557p. (In German). NTIS (US Sales Only), PC A24. Order Number DE88770249/JAW.

Vol. 88 of the 'General Gas Rates in the Federal Republic of Germany' is the latest in the series published by the Bundesverband der deutschen Gas- und Wasserwirtschaft e.V. (BGW). Gas rates for private, industrial and commercial consumers in the Federal Republic of Germany are presented as of January 1, 1988. Data are presented on special rates (full supply, heating) as far as these were accessible to the Bundesverband. (orig.)

44676 (PB—88-205901/XAB) **Introduction to GRI (Gas Research Institute).** (Gas Research Inst., Chicago, IL (USA)). 1988. 20p. (GRI—88/0069). NTIS, PC A03/MF A01.

Color illustrations reproduced in black and white.

This primer presents in question-and-answer format an introduction to GRI, its membership and operation, funding and leveraging of funds, structuring and implementation of the GRI research and development program, and the GRI Five-Year Plan. Some of GRI's major accomplishments are also cited.

44677 (PB—88-208830/XAB) Electric and gas rates for the residential and commercial sectors: 1987. Topical report. Schoening, N.C. (Alabama Univ., Huntsville (USA). Center for High Technology Management and Economic Research). Mar 1988. 434p. (UAH-RR—673). NTIS, PC A19/MF A01.

To perform evaluations of gas-fueled and competing technologies in the residential and commercial sectors, complete and accurate information on fuel prices is necessary. A data-base report is provided on electric and gas rates for 45 U.S. locations in the winter and summer of 1987. The rates include usage charges, demand charges, fuel-cost adjustments, taxes, and surcharges. The data represent rates in effect as of January 1 and June 1, 1987. The construction of the data base satisfies both the immediate need of fuel prices to compute operating costs and the longer-term requirement of the analysis of rate structures for characteristics and trends.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 44639, 45687, 45688

0309 Artificial Stimulation

44678 (PB—88-210661/XAB) Rock Creek Methane from Multiple-Coal-Seams Completion Project. Semiannual report, July 1987-December 1987. Beavers, C.D.; Dobscha, F.X.; Green, C.D.; Lambert, S.W.; Boyer, C.M. (Taurus Exploration, Inc., Birmingham, AL (USA)). Mar 1988. 391p. NTIS, PC A17/MF A01.

See also PB—87-102166; Portions of this document are not fully legible.

Phase I of the Rock Creek Methane from Multiple Coal Seams Completion Project is a multiyear joint venture investigating the combination of drilling, completion, stimulation, and production parameters required for the viable economic production of methane from shallow, multiple coal seams. Project activities at the Rock Creek site in 1987 focused on well drilling and completion, with special emphasis on wellbore acess and hydraulic stimulation. Data on drawdown analysis of the Mary Lee coal group, and testing limited-entry applications to multiseam simulation are included.

44679 (PB—88-216858/XAB) Co-production of gas and water. Final report, November 1984-December 1987. Howell, R.W.; Peterson, K.P. (Eaton Operating Co., Inc., Houston, TX (USA)). May 1988. 108p. NTIS, PC A06/MF A01.

See also PB—86-154556.

The objectives of the research effort were to locate, evaluate, acquire and test one or more co-production prospects. A prospect identification program was developed to locate prospective co-production reservoirs on the Texas Gulf Coast. The reservoirs identified were ranked according to their potential for enhanced gas recovery, monitored, and updated from industry activity at or near the prospects. N.E. Hitchcock, one of the two highest ranked, of the 42 prime prospects, was recommended to and approved by GRI as a co-production test project. The project, currently in progress, proceeded in three distinct areas: (1) research on water treatment of brine produced in conjunction with gas; (2) a field-wide test of the Frio 9100' reservoir; and, (3) development and implementation of an integrated, high volume brine disposal system. While the water-treatment study has been completed, co-production testing and work on the brine disposal system are currently in progress. The second prospect, Port Arthur, was tested and subsequently purchased by industry for continued development.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 44652, 44667, 44669

44680 (NEI-NO—44, pp 351-365) Underwater production facilities for South Bassein to Hazira Pipeline Project. Baschieri, M.; Biagini, P.; Snamprogetti, A.F. 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper describes the design, construction and installation of seven subsea PLEMs (Pipeline End Manifolds) for the South Bassein to Hazira Pipeline Project. The South Basein gas fields, located off the western coast of India, reach a maximum depth of 54 m and are exploited according to a staged development plan. Consequently, the complexity of the pipeline network must adapt to the different phases and the subsea equipment must allow for the required modifications. Within this picture, the PLEMs become a fundamental component of the production system, acting as terminals for the sealines or as interconnecting system for a number of lines. The PLEMs consist of valves and piping for the control, manifolding and distribution of hydrocarbons according to the various development stages of the fields. Depending on the soil bearing capacity and the functions it is called to perform, the structure of the system is positioned on the sea bottom either by gravity or with piles. The peculiarity of this system is the installation on the seabottom - on extremely weak soil - of a complex which is usually installed on shore or on an offshore platform. The installation of PLEMs for the South Bassein project was completed early 1985 for both the gas and condensate transportation systems with lines ranging between the outer diameters of 12 and 36 inches. 1 table.

44681 (NEI-NO—44, pp 389-411) Damage to subsea electro hydraulic control umbilicals - one operators experience. Gibby, P.J. (BP Petroleum Development Ltd., Aberdeen (UK)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper recounts the experiences of BP as Operator of the Northern Leg Gas Pipeline (NLGP) System after the electro hydraulic valve control umbilical at the Murchison/Thistle spur line tie-in to the main trunk line was snagged, damaged and severed in late June 1985. The remedial works programme carried out over the period July - Mid December 1985 covered complete replacement of the umbilical and associated valve control system components at a water depth of 155 m. Two systems or /sup s/preads/sup /were used to carry out the works. The first for diverledd retrieval of the damaged umbilical followed by the simultaneous lay/bury of the new umbilical. The second to carry out all diving works associated with the umbilical pull-in and control equipment replacement at the spur line/trunkline tie in point. The paper outlines the NLGP Umbilical design which includes subsea pyrotechnic safety cutters for protection of the pipeline system. the various stages of the remedial works project are presented form initial response to the emergency and damage assessment, through development and implementation of the works offshore. 7 drawings.

44682 (NEI-SE—17) Test plant for building gas pipeline in bog soil - in winter. Lind, B.; Markgren, H. (Swedish State Power Board, Vaellingby). 1 Oct 1986. 128p. (In Swedish). NTIS (US Sales Only), PC A07. Order Number DE88753706/JAW.

The aim of this RD-D project was to provide the technical and economical basis of the ice-road concept and to study the suitability of different working methods and working machines. Summary of results: -the technique has good technical and economical opportunities for application in northern Sweden; -a certain degree of ground frost above a pipe trench is required where excavation is performed by heavy machines; -removal of ground frost layer in stone-less wetland should be initiated by sawing trench profiles; -where sawing is unsuitable, e.g. by presence of stones, the ground frost layer could be broken through by a rakerless saw; -trench excavation should be performed by means of an especially shaped bucket, so-called profilebucket, to achieve a suitable slope inclination; -excavation materials put up along the trench freeze comparatively slow and could be left overnight without appreciable freezing also at very low temperatures; -pipe laying should be executed the same day as trench excavation; -the frozen peat layer forms a strong and enduring working area, withstanding heavy loads also close to an excavated trench; -effective refill by means of a deep digger is difficult because of limited reach together with a risk of damageing the pipe by handling and bringing back piled lumps of frozen ground; -influence on ground after executed restoration work will be most limited. (authors).

44683 **(PB—88-205836/XAB) Feasibility and analysis of fluidic-type devices in gas-flow measurements. Final report, March 1986-March 1987.** Williams, D.R. (Illinois Inst. of Tech., Chicago (USA). Fluid Dynamics Center). Dec 1987. 65p. NTIS, PC A04/MF A01.

An investigation into the feasibility of using fluidic oscillators as residential gas meters was conducted. The initial studies have shown that the fluidic-type meter will operate with both laminar and turbulent internal flows. This means it is feasible to design a meter that can operate over the required range of 0.25 cfh to 200 cfh. Changes in the shape of the internal passages have a major effect on the performance characteristics of the meter. By properly designing these passage ways it would be possible to adjust the meter to have a linear calibration over its entire range of operation. Flow visualization and pressure measurements were made on a fluidic-type flow meter (originally designed by Wright in Australia). The objective of the studies was to understand the basic fluid-dynamic processes at play, especially at the low flow rates where the meter stops operating. By making systematic changes to the internal passages in the meter, it has been possible to determine the sensitivity of the calibration to the various components of the meter.

0340 Combustion

REFER ALSO TO CITATION(S) 44938, 45231, 45304

0350 Storage

REFER ALSO TO CITATION(S) 44625

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 44688

0404 Oil Production, Recovery, And Refining

44684 **(DOE/METC—88/0258) Oil shale: Technology status report.** (USDOE Laramie Project Office, WY). Oct 1986. 79p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE88001018/JAW.

This report documents the status of the US Department of Energy's (DOE) Oil Shale Program as of the end of FY 86. The report consists of (1) a status of oil shale development, (2) a description of the DOE Oil Shale Program, (3) an FY 86 oil shale research summary, and (4) a summary of FY 86 accomplishments. Discoveries were made in FY 86 about the physical and chemical properties and behavior of oil shales, process chemistry and kinetics, in situ retorting, advanced processes, and the environmental behavior and fate of wastes. The DOE Oil Shale Program shows an increasing emphasis on eastern US oil shales and in the development of advanced oil shale processing concepts. With the award to Foster Wheeler for the design of oil shale conceptual plants, the first step in the development of a systems analysis capability for the complete oil shale process has been taken. Unocal's Parachute Creek project, the only commercial oil shale plant operating in the United States, is operating at about 4000 bbl/day. The shale oil is upgraded at Parachute Creek for input to a conventional refinery. 67 refs., 21 figs., 3 tabs.

44685 **(NP—8770325) Pyrolysis of Canadian oil sand in an indirectly heated, semi-industrial fluidized bed, in consideration of educt supply.** Steinstrasser, F.A. (Hamburg Univ. (Germany, F.R.). Fachbereich 13 - Chemie). 19 Sep 1986. 171p. (In German). NTIS (US Sales Only), PC A08. Order Number DE88770325/JAW.

The Hamburg pyrolysis process for oil extraction from tar sands is characterized in that the separation of bitumen and tar and the thermal cracking of the raw bitumen take place in a single process stage, without any additives that need to be removed from the process. The mineral residues, after combustion of the soot in a downstream fluidized bed, can be dumped without problems or may be used for backfilling in mines. Compared with other processes, the environmental impact of pyrolysis is low while achieving optimum oil yields. The main constituents of the off-gas are methane, ethane, ethene, and propene. The hydrogen fraction is larger than 16% by volume. The main constituents of the oils are BTX aromatic hydrocarbons, styrene and naphthalene, and higher-condensed aromatic hydrocarbons.

44686 **(UCRL—98221) Oil shale retorting in dense phase hot-solid recycle systems.** Cena, R.J.; Taylor, R.W. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 8p. (CONF-880589—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012433/JAW.

From International conference on oil shale and shale oil; Beijing, China (16 May 1988).

Oil shale processing remains primitive despite more than a century of study and development. To expand the industry in China, and to develop an industry in the USA, more efficient, environmentally acceptable oil shale retorting schemes are required. Rapid pyrolysis, soil-recycle retorts offer high throughput and improved oil yield compared to hot gas retorts currently in operation. At the Lawrence Livermore National Laboratory (LLNL), we are studying this class of retort, by combining laboratory and mathematical model development efforts with operation of a 1 tonne/day pilot-scale, solid-recycle retorting system. In this paper we first discuss hot gas and hot solid retorting methods. We then compare laboratory pyrolysis kinetic and yield results with those obtained using the LLNL pilot retort, processing both Western and Eastern USA shales. Sulfur chemistry important in solid-recycle retorting is discussed. Based on this experience, coupled with laboratory measurement for shales from Maoming and Fushun, China we discuss the possibility of processing Chinese shales in rapid-pyrolysis, solid-recycle retorting systems. 8 refs., 3 figs., 6 tabs.

44687 **Oil shale heat-capacity relations and heats of pyrolysis and dehydration.** Camp, D.W. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)). pp 130-144 of The twentieth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1987). (CONF-8704104—).

From 20. oil shale symposium; Golden, CO, USA (21 Apr 1987).

New relations are developed for calculating enthalpy changes during heating, retorting, or cooling of raw, spent, or burned oil shales of various compositions. The relations describe the sensible heats of the minerals, kerogen, and char, and the reaction heats of kerogen pyrolysis and bound-water dehydration. The mineral sensible heat is obtained by summing the "handbook" enthalpy values of the constituent minerals. A relation for the heat capacities of kerogen and char as a function of their molecular formula and temperature is developed by correlating the heat capacities of several model organic compounds. Simpler relations for mineral, kerogen, and char heat capacities are derived specifically for Green River shale. For Green Rikver shale, a relation for the extent of mineral dehydration as a function of temperature and a value for the heat of this dehydration are based on available data. The heats of Green River kerogen pyrolysis at 500°C after rapid heating, and near 350° during slow heating are obtained by careful analysis of existing data.

44688 **In situ retorting of nonuniform oil shale rubble.** Sudduth, B.C.; Merriam, N.W.; Cha, C.Y.; Vaughn, P.; Turner, T.F. (Western Research Institute, P.O. Box 3395, University Station, Laramie, WY (US)). pp 89-100 of The twentieth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1987). (CONF-8704104—).

From 20. oil shale symposium; Golden, CO, USA (21 Apr 1987).

Nonuniform oil shale rubble beds were retorted in a series of 10 tests using the 10-ton retort at the Western Research Institute. In all of these tests, two different size distributions of oil shale rubble were loaded into separate portions of the retort cross section. This loading procedure achieved permeability ratios in the range of

0.019 to 0.97 between the two different portions of the retort cross section, and the fractional cross-sectional area of the smaller region ranged from 0.05 to 0.50 of the total retort cross section. In each retorting test, the gas flow distribution was measured at cold flow conditions, and the nonuniform rubble bed was retorted using direct combustion with air or air and steam mixtures. The first nine retorting tests have demonstrated that the oil yield from the less permeable region decreases in proportion to the square root of the permeability ratio between the two different shale size distributions. The measured oil yields correspond to the combined predictions of one-dimensional model calculations for each separate portion of the rubble bed. The dimensionless response times of gas tracers also correlate with the measured oil yields.

44689 **Oil yield losses during low void volume combustion retorting of oil shale.** McLendon, R.; Miller, R. (US Dept. of Energy, Morgantown Energy Technology Center/Laramie Project Office, P.O. Box 1189, Laramie, WY (US)). pp 101-112 of The twentieth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1987). (CONF-8704104—).

From 20. oil shale symposium; Golden, CO, USA (21 Apr 1987).

Stacked oil shale bricks, with overall void volumes from 8.4% to 18.4% were combustion retorted in a batch, pilot scale sized reactor. Experimental parameters were total void volume, oil shale grade, particle size, and retorting gas flow rate and composition. A hypothetical "base case" of experimental conditions was chosen to be in the region of commercial interest and the experimental parameters were individually varied from their base values. Oil yield was the dependent variable. Results indicate retorting of oil shale at very low voids is possible and efficient. Decreasing particle size and interstitial velocity and addition of steam increased oil yields. Oil yields varied from 70% to 83% of Fischer assay.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 44684, 44689

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 44685

0410 Environmental Aspects

REFER ALSO TO CITATION(S) 44684, 44685

05 NUCLEAR FUELS

0501 Reserves, Exploration, And Mining

44690 **(INIS-BR—1141) Brazilian uranium exploration program.** Marques, J.P.M. (NUCLEBRAS, Rio de Janeiro (Brazil)). 1981. 55p. (CONF-8109290—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88703241/JAW.

From International conference on uranium; Quebec, Canada (15 Sep 1981).

General information on Brazilian Uranium Exploration Program, are presented. The mineralization processes of uranium depoits are described and the economic power of Brazil uranium reserves is evaluated. (M.C.K.).

0505 Uranium Enrichment

44691 **(BNFL-Inf-Series—35(CA)) Gas centrifuge bibliography 1983-1986.** Lowe, G.E.; McLeod, D.F.; Roberts, P. (comps.). (British Nuclear Fuels Ltd., Risley). Mar 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754139/JAW.

A bibliography is presented of the gas centrifuge literature published from 1983-1986 inclusive. It supplements PG Information Series 25(CA), BNFL Information Series 15(CA), BNFL Information Series 23 (CA), and BNFL Information Series 27(CA), which together cover the period 1895-1982. The main arrangement is chronological and there are author, report number, and subject indexes. (U.K.).

44692 **(INIS-BR—1064) Ideal cascade for uranium 235 enrichment by centrifuge jet nozzle process.** Santos, E.C. dos. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Ciencia dos Materiais e Metalurgia). 1981. 177p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88702867/JAW.

The design of an ideal cascade for the process of isotope separation by centrifugation for the U/sup 235/ enrichment, is presented. A selection of building materials used in fabrication of isotope separation plants, showing the importance of aluminium, due the bauxite mines in Northern Brazil, is done. (M.C.K.).

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 45415, 45877

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 44781, 45440, 45441, 45487

44693 **(CEA-CONF—9128) Modernization and enlarging of the Marcoule pilot plant for R and D.** Calame-Longjean, A.; Revol, G.; Roux, J.P.; Ranger, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1987. 7p. (In French). (CONF-870801—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754196/JAW.

From International conference on nuclear fuel reprocessing and waste management (RECOD '87); Paris, France (24 Aug 1987).

The aim of the pilot plant is the testing of process and equipment in actual conditions with spent fuels on a half-industrial scale and for a significant time. From 1963 to 1983 more than 11t of spent fuels (mainly from fast reactors) were reprocessed. Since 1983 the pilot plant has been modernized and enlarged and this paper describes the new plant of the TOR project (treatment of oxides from fast reactors).

44694 **(CEA-CONF—9134) Purex process modelling.** Boullis, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1987. 7p. (In French). (CONF-870801—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754197/JAW.

From International conference on nuclear fuel reprocessing and waste management (RECOD '87); Paris, France (24 Aug 1987).

The development of reprocessing in France, in particular UP3 and UP2.800 plants at La Hague, requires the optimization of processes and equipments for a considerable increase of capacity and versatility (varied spent fuels). For each operation of the cycle the simulation is realized by a phenomenologic analysis, physicochemical data acquisition, qualification and use of validated models for process optimization.

44695 **(Juel-Conf—61, pp 135-145) R and D activities for interim storage of HTR spent fuel elements.** Duwe, R.; Brinkmann, U.; Christ, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.); Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

For HTR spent fuel interim storage, only dry storage facilities are commercially used or planned. There are two waste form and storage concepts available which are currently tested at KFA, partly using prototypes for the experiments: Piling up of fuel ele-

ment-flasks behind a concrete shielding, or storage in transportable containers. Measuring programmes are carried out in order to experimentally ascertain significant design data, as e.g. on thermal conditions, radioactivity containment, and limitation of direct radiation. The site operational and measured data confirm the technical and radiological safety of the dry interim storage according to both concepts. Additional laboratory-scale measurement of the release of Kr-85 and tritium, which are the only mobile activity sources at the given storage temperatures of 30/sup 0/C up to max. 400/sup 0/C, confirm the activity release model underlying the storage site design.

44696 (RI—197) Distribution of extracted components in a differential contact extractor. Dushin, V.N.; D'yachenko, A.T.; Perepech, K.V.; Rubchenya, V.A.; Shpunt, L.B. (Radievyj Inst., Leningrad (USSR)). 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702953/JAW.

On the basis of material balance conditions a system of differential equations describing the distribution of components along the column height is derived. The problem of component transfer through spherical and flat phase interface is solved by difference methods. The results obtained with a diffusion model of mass transfer are used in a mathematical model of component distribution. The system of equations together with boundary conditions are reduced to a variational problem solved by numerical methods of dynamic programming. The results of calculation of uranyl nitrate and nitric acid distribution in two-component extraction system are presented. 5 refs.; 4 figs.

44697 TMI-2 fuel canister and core sample handling equipment used in INEL hot cells. McConnell, J.W.; Shurtliff, W.T.; Lynch, R.J.; Croft, K.M.; Whitmill, L.J.; Allen, S.M. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 457-464 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

This paper describes the specialized remote handling equipment developed and used at the Idaho National Engineering Laboratory (INEL) to handle samples obtained from the core of the damaged Unit 2 reactor at Three Mile Island Nuclear Power Station (TMI-2). Samples of the core were removed, placed in TMI-2 fuel canisters, and transported to the INEL. Those samples will be examined as part of the analysis of the TMI-2 accident. The equipment described herein was designed for removing sample materials from the fuel canisters, assisting with initial examinations, and processing samples in preparation for detailed examinations. The more complex equipment used microprocessor remote controls with electric motor drives providing the required force and motion capabilities. The remaining components were unpowered and manipulator assisted.

44698 Analysis of radiation doses for a transportation system and its interface operations for commercial spent fuel. Schneider, K.J.; Ross, W.A.; Smith, R.I.; Wilmot, E.L. (Battelle Pacific Northwest Lab., Richland, WA (US)). pp 375-380 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

This paper gives the results of estimates of aggregated radiation doses to the affected public and workers in the U.S. that would be associated with loading spent fuel at the reactors, transporting the spent fuel by truck and rail, and receiving and unloading the spent fuel at a deep geological repository. The estimates are for a postulated transportation-related system using current state-of-the-art technology, if employed in the high-level waste management system in the future, and the approximate dose reduction from some potential system improvements. The results of the study provide a starting point for the U.S. Department of Energy (DOE) to develop and improved transportation system that is cost effective, safe, and results in low radiation doses.

44699 United States Department of Energy commercial reactor spent fuel programs being conducted at the Idaho National Engineering Laboratory. Piscitella, R.R.; Rasmussen, T.L.; Uhl, D.L. (EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 475-480 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

In 1982, the Congress of the United States enacted the Nuclear Waste Policy Act (NWPA). This act stated that in exchange for one mil per kilowatt of electricity generated by nuclear power, the U.S. Department of Energy (DOE) would take possession of the Utilities' nuclear spent fuel and provide for permanent disposal. The act also provided for establishment of the Office of Civilian Radioactive Waste Management (OCRWM) within the DOE to manage the NWPA programs. The Idaho National Engineering Laboratory participation in OCRWM programs includes the Spent Fuel Storage Cask Testing Program, Dry Rod Consolidation Technology Program, Prototypical Consolidation Demonstration Program, the Nuclear Fuel Services Project, and the Cask Systems Acquisition Program. The Dry Rod Consolidation Technology Program demonstrates dry consolidation of PWR fuel assemblies and develops and documents technology associated with the dry consolidation process. The Prototypical Consolidation Demonstration Program develops and demonstrates production-scale equipment for the dry consolidation and packaging of spent fuel rods contained in BWR and PWR spent fuel assemblies and reports the results of these activities. The Nuclear Fuel Services Project will demonstrate the feasibility of packaging, transporting, and storing commercial spent fuel in the same dry storage cask. The Cask System Acquistion Program will develop a complement of NRC certified prototype casks for shipment of spent PWR and BWR fuels and hardware from existing and proposed reactor facilities and solidified high-level waste to a repository or an MRS.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 44791

44700 (PNL-SA—15572) Estimated effects on radiation doses from alternatives in a spent fuel transportation system. Schneider, K.J.; Ross, W.A.; Smith, R.I. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 8p. (CONF-880631—28). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014078/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper contains the results of a study of estimated radiation doses to the public and workers from the transport of spent fuel from commercial nuclear power reactors to a geologic repository. A postulated reference rail/legal-weight truck transportation system is defined that would use current transportation technology, and provide a breakdown of activities and time/distance/dose-rate estimates for each activity within the system. Collective doses are estimated for each of the major activities at the reactor site, in transit, and at the repository receiving facility. Annual individual doses to the maximally exposed individuals or groups of individuals are also estimated. The dose-reduction potentials and costs are estimated for a total of 17 conceptual alternatives and subalternatives to the postulated reference system. Most of the alternatives evaluated are estimated to provide both cost and dose reductions. The major conclusion is that the potential exists for significant future reductions in radiation doses to the public and workers and for reductions in costs compared to those based on a continuation of past practices in the US.

0520 Waste Management

REFER ALSO TO CITATION(S) 44699, 44829, 44830, 45022, 45055, 45361, 45362, 45450, 45491, 45727, 45728, 45774, 46138, 46152, 46157

44701 (AERE-R—11854) Solubility-limited source-term model for the geological disposal of cemented intermediate-level waste. Robinson, P.C.; Hodgkinson, D.P.; Tasker, P.W.; Lever, D.A.; Windsor, M.E.; Grime, P.W.; Herbert, A.W. (UKAEA Harwell Lab. Theoretical Physics Div.). Apr 1988. 72p. (ILWRP—87/P.12). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754262/JAW.

This paper presents and illustrates the use of a source-term model for an intermediate-level radioactive-waste repository. The model deals with the behaviour of long-lived nuclides after the initial containment period. The major processes occurring in the near field are included, namely sorption, elemental solubility limits, chain decay and transport due to groundwater flow. The model is applied to a realistic example of ILW disposal. From this it is clear that some nuclides are present in sufficient quantities to reach their solubility limit even when the assumed sorption coefficients are large. For these nuclides the precise sorption coefficient is unimportant. It is also clear that some daughter products, in particular Pb-210, become significant. The toxicity of the repository pore water is calculated and it is shown that, although this toxicity is high compared to levels acceptable in drinking water, it is much lower than the toxicity of the waste itself. However, the near-field chemical environment is only one of a number of containment barriers. In addition, it has been shown that the rate at which radionuclides enter the rock surrounding the repository is very low.

44702 (AERE-R—12618) Measurement of incorporation levels of vitrified waste by X-ray absorptiometry. Taylor, B.L.; Metcalfe, B.; Russen, L.C. (UKAEA Harwell Lab. Instrumentation and Applied Physics Div.). Feb 1988. 30p. H.M. Stationery Office, London, price Pound 5.00.

Absorptiometric measurements on inactive simulants of HA vitrified waste have been carried out using a narrow beam of X-rays from an X-ray tube generator and both sodium iodide and high resolution solid state detectors. A functional relationship between the transmitted beam intensity and the percentage incorporation level of the glass has been established under a variety of experimental conditions. In addition, certain elements in the waste oxide can be individually identified by inspection of the absorption edge structure in the 18-50 keV region. Measurement of fully active glass samples has shown that the radiations from the sample do not adversely affect the absorptiometric measurements.

44703 (AERE-R—12856) Summary of experimental work during 1986/1987 on actinide decontamination to low-levels. Cross, J.E.; Holwell, G.J.; Hooper, E.W. (UKAEA Harwell Lab. Chemistry Div.; Department of the Environment, London (UK)). Sep 1987. 11p. (DOE-RW—87.127; LETTF—87-P38; PCMRP—87-P12). H.M. Stationery Office, London, price Pound 4.00.

The results from a preliminary experimental investigation of treatment processes for the decontamination of α-bearing waste effluents to very low-levels (< 10/sup -3/ Bq/ml) are reported. Two types of processes for the removal of plutonium and americium from a simple simulated effluent were considered; (i) ferric floc precipitation and (ii) ultrafiltration used in combination with finely divided inorganic absorbers. From the ferric floc experiments it is concluded that the decontamination is improved by increasing the iron concentration; the highest concentration examined (500 ppm iron) resulted in plutonium and americium supernate activities of ~ 1 x 10/sup -3/ Bq/ml. Ultrafiltration processes were found to give better decontamination than the floc processes. In all the experiments the resultant permeate activities for both plutonium and americium were < 1 x 10/sup -3/ Bq/ml, with levels down to 5 x 10/sup -5/ Bq/ml being achieved under some conditions. Further work will examine the performance of the ultrafiltration processes on actinide removal from real wastes or more realistic simulants which include some of the complexants found in waste effluents.

44704 (BMI/ONWI/C—13) Deaf Smith County noise analysis: Revision 2. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; NUS Corp., Gaithersburg, MD (USA)). Nov 1985. Contract AC06-76RL01830;AC02-87CH10290. 514p. (BMI/ONWI—692; NUS—4943). H. Order Number DE88013739/JAW.

An analysis of activities proposed for the three major phases of development of the proposed nuclear waste repository site in Deaf Smith County, Texas, was conducted to quantify the noise levels and the effect of noise resulting from these activities. The report provides additional details of the predictive noise level modeling conducted for the site characterization, repository construction, and repository operation phases. Equivalent day/night sound levels are presented for each phase as sound level contours. Sound levels from onsite and offsite activities are addressed including traffic on access routes, and railroad construction and operation. A description of the predictive models, the analysis methodologies, the noise source inventories, the model outputs, and the evaluation criteria are included. 35 refs., 6 figs., 2 tabs.

44705 (BMI/ONWI/C—14) Deaf Smith County air quality analysis: Letter report: Revision 2. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Nov 1985. Contract AC02-87CH10290;AC06-76RL01830. 327p. (BMI/ONWI—689). H. Order Number DE88013631/JAW.

Air quality impacts due to site characterization, and repository construction and operation activities were evaluated in the Deaf Smith County Site, Texas environmental assessment (EA). The analyses on which the impact assessments are based made with dispersion models recommended by the EPA for such applications, meteorological data from a nearby representative National Weather Service station at Amarillo, Texas, and available background air quality data from an urban monitoring location. Maximum offsite concentrations of total suspended particulates, nitrogen dioxide, sulfur dioxide, and carbon monoxide were estimated for periods of maximum emissions identified for each pollutant. Estimates of total annual salt deposition resulting from repository salt handling operations were also made. 36 refs., 5 figs., 17 tabs.

44706 (BMI/ONWI/C—25) Noise source emissions, Deaf Smith County site, Texas. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Battelle Memorial Inst., Columbus, OH (USA)). 13 May 1987. Contract AC02-87CH10290. 385p. (BMI/ONWI—695). H. Order Number DE88013703/JAW.

Noise source data and use factors for modeling the noise environment expected from salt site repository activity were provided by Battelle Columbus Division. This report has been prepared for the purpose of documenting the development of the data provided to the Repository Project Management (RPM) organization. The data provided encompass all phases of activity from site preparation through construction of the exploratory shaft facility (ESF). Noise environments expected from construction and operation of transportation corridors associated with the activity were also modeled. The equipment inventory, including sound-power levels for each item, is included. Emission source terms provided by Parsons Brinckerhoff/PB-KBB for the ESF were used as a basis for the noise-source emission inventory development. Where available, research results containing complete spectra were used. In cases where complete data were not available, a sound-pressure spectrum was synthesized from a characteristic spectrum shape from a similar piece of equipment. For example, a front-shovel excavator might be approximated by data from a front-end loader of similar horsepower range. Sound-power-level spectra were then calculated from the sound-pressure-level data. 2 refs.

44707 (BMI/ONWI/C—26) Noise source emissions, Richton Dome site, Mississippi. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Battelle Columbus Div., OH (USA)). 13 May 1987. Contract AC02-87CH10290. 512p. (BMI/ONWI—696). H. Order Number DE88013687/JAW.

Noise source data and use factors for modeling the environmental noise environment expected from salt-site repository activity

were provided by Battelle Columbus Division. This report has been prepared for the purpose of documenting the development of the data provided to the Repository Project Management (RPM) organization. The data provided encompasses all phases of activity, from site preparation through construction of the exploratory shaft facility (ESF). Noise environments expected from construction and operation of transportation corridors associated with the activity were also modeled. Data for the construction of transportation corridors were provided. The equipment inventory, including sound-power levels for each item is included as Appendix A. Emission source terms provided by Parsons Brinckerhoff/PB-KBB for the ESF were used as a basis for the noise source emission inventory development. Where available, research results containing complete spectra were used. In cases where complete data were not available, a sound-pressure spectrum was synthesized from a characteristic spectrum shape from a similar piece of equipment. For example, a front-shovel excavator might be approximated by data from a front-end loader of similar horsepower range. Sound-power-level spectra were then calculated from the sound-pressure-level data. 14 refs.

44708 **(BMI/ONWI/C—27) Nuclear waste repository simulation experiments (brine migration), Asse Mine of the Federal Republic of Germany: Quarterly brine migration data report, October--December 1985.** Eckert, J.L.; Kalia, H.N.; Coyle, A.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1988. Contract AC02-87CH10290. 252p. (BMI/ONWI—676). H. Order Number TI88013734/JAW.

The tenth brine migration data report describes experiments simulating a nuclear waste repository at the 800-m (2624-ft) level of the Asse Salt Mine in the Federal Republic of Germany from May 1983 through December 1985. This report describes the test equipment, the Asse Salt Mine, and the pretest properties of the salt in the test gallery. This report includes test data for 31 months of operations on brine migration rates, borehole pressure, salt temperatures and thermomechanical behavior of the salt. 3 refs., 118 figs., 93 tabs.

44709 **(BMI/ONWI/C—31) Richton Dome noise analysis: Revision 2.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Bechtel National, Inc., San Francisco, CA (USA)). Nov 1985. Contract AC02-87CH10290. 341p. (BMI/ONWI—693). H. Order Number DE88013304/JAW.

A study was performed as part of the Civilian Radioactive Waste Management Program to quantify the level and effect of noise from the various major phases of development of the proposed potentially acceptable nuclear waste repository site at Richton Dome, Mississippi. This report contains the results of a predictive noise level study for the site characterization, repository construction, and repository operational phases. Included herein are graphic representations of energy averaged day/night sound levels representing impact zones expected during each phase. Sound levels from onsite and offsite activity including traffic on highways and railroad routes are presented in isopleth maps. A description of the Environmental Noise Prediction Model used for the study, the study basis and methodologies, and actual modeling data are provided. Noise and vibration levels from blasting are also predicted and evaluated. Protective noise criteria containing a margin of safety are used for persons in relation to residences, schools, churches, and agricultural areas. Protective ground motion criteria for residential dwelling and for human annoyance are used in the evaluation. The evaluation provides the bases for assessing the noise impacts from the related activities at the proposed repository. 24 refs., 8 figs., 8 tabs.

44710 **(BMI/ONWI/C—32) Richton Dome air quality analysis: Revision 2.** (Bechtel National, Inc., San Francisco, CA (USA)). Nov 1985. Contract AC02-87CH10290;AC02-83CH10140. 412p. (BMI/ONWI—690). H. Order Number DE88013310/JAW.

Detailed supporting calculations, methodology and results of the air quality analysis performed for the Richton Dome Environmental Assessment are presented in this report. Maximum emission rates during site characterization and repository construction and operation are analyzed and reported. The major source of emissions is fugitive dust from construction activities. Modeling was performed primarily with the US Environmental Protection Agency Industrial Source Complex (ISC) Model and meteorological data from Jackson, Mississippi. Predicted maximum ground level concentrations off site are presented. Supporting calculations and computer model runs are presented in appendixes. Salt deposition around the site was predicted and results and supporting analyses are presented. 4 refs., 1 fig., 21 tabs.

44711 **(BMI/ONWI/C—41) Alternative methods of salt disposal at the seven salt sites for a nuclear waste repository.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). Feb 1987. Contract AC02-87CH10290. 28p. H. Order Number TI88011643/JAW.

This study discusses the various alternative salt management techniques for the disposal of excess mined salt at seven potentially acceptable nuclear waste repository sites: Deaf Smith and Swisher Counties, Texas; Richton and Cypress Creek Domes, Mississippi; Vacherie Dome, Louisiana; and Davis and Lavender Canyons, Utah. Because the repository development involves the underground excavation of corridors and waste emplacement rooms, in either bedded or domed salt formations, excess salt will be mined and must be disposed of offsite. The salt disposal alternatives examined for all the sites include commercial use, ocean disposal, deep well injection, landfill disposal, and underground mine disposal. These alternatives (and other site-specific disposal methods) are reviewed, using estimated amounts of excavated, backfilled, and excess salt. Methods of transporting the excess salt are discussed, along with possible impacts of each disposal method and potential regulatory requirements. A preferred method of disposal is recommended for each potentially acceptable repository site. 14 refs., 5 tabs.

44712 **(BMI/ONWI/C—44) Salt Repository Project site study plan for stratigraphic boreholes: Revision 1, December 18, 1987.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stone and Webster Engineering Corp., Boston, MA (USA)). 18 Dec 1987. Contract AC02-87CH10290;AC02-87CH10285. 67p. H. Order Number TI88011651/JAW.

This site study describes the Stratigraphic Boreholes field work to be conducted during the early stages of Site Characterization at the Deaf Smith County, Texas site. The field program has been designed to provide data useful in addressing information/data needs resulting from Federal/State/local regulations, and repository program requirements. Four Stratigraphic Holes will be drilled near the perimeter of the site to document the subsurface geologic conditions in that area and to provide data necessary for design and construction of the Exploratory Shaft Facilities. Continuous samples will be recovered from the ground surface to the total depth of each sell. Geophysical well logs will provide additional coverage of the stratigraphic section. In-situ down hole testing will include short term hydrologic tests and hydraulic fracture tests to provide information on deep groundwater characteristics and regional stress patterns, respectively. Field methods/tests are chosen that provide the best or only means of obtaining the required data. The Salt Repository Project (SRP) Networks specify the schedule which the program will operate. The Technical Services Contractor is responsible for conducting the field program of drilling and testing. Samples and data will be handled and reported in accordance with established SRP procedures. A quality assurance program will be utilized to assure that activities affecting quality are performed correctly and that the appropriate documentation is maintained. 30 refs., 13 figs., 4 tabs.

44713 **(BMI/ONWI/C—58) Salt Repository Project transportation program plan.** Fisher, R.L.; Greenberg, A.H.; Anderson, T.L.; Yates, K.R. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 2 Nov 1987. Contract AC02-87CH10290. 150p. H. Order Number TI88013312/JAW.

The Salt Repository Project (SRP) has the responsibility to develop a comprehensive transportation program plan (TrPP) that

treats the transportation of workers, supplies, and high-level radioactive waste to the site and the transportation of salt, low-level, and transuranic wastes from the site. The TrPP has developed a systematic approach to transportation which is directed towards satisfying statutes, regulations, and directives and is guided by a hierarchy of specific functional requirements, strategies, plans, and reports. The TrPP identifies and develops the planning process for transportation-related studies and provides guidance to staff in performing and documenting these activities. The TrPP also includes an explanation of the responsibilities of the organizational elements involved in these transportation studies. Several of the report chapters relate to identifying routes for transporting nuclear waste to the site. These include a chapter on identifying an access corridor for a new rail route leading to the site, identifying and evaluating emergency-response preparedness capabilities along candidate routes in the state, and identifying alternative routes from the state border, ports, or in-state reactors to the site. The TrPP also includes plans for identifying salt disposal routes and a discussion of repository/transportation interface requirements. 89 refs., 6 figs.

44714 **(BMI/ONWI/C—65) Site Study Plan for background environmental radioactivity, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 87p. H. Order Number TI88013300/JAW.

The Background Environmental Radioactivity Site Study Plan describes a field program consisting of an initial radiological survey and a radiological sampling program. The field program includes measurement of direct radiation and collection and analysis of background radioactivity samples of air, precipitation, soil, water, milk, pasture grass, food crops, meat, poultry, game, and eggs. The plan describes for each study: the need for the study, the study design, data management and use, schedule of proposed activities, and quality assurance requirements. These studies will provide data needed to satisfy requirements contained in, or derived from, the Salt Repository Project (SRP) Requirements Document. 50 refs., 11 figs., 7 tabs.

44715 **(BMI/ONWI/C—66) Site study plan for cultural resources, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 101p. H. Order Number TI88013302/JAW.

The Cultural Resources Site Study Plan describes a field program to identify and evaluate the archaeological, historical, and Native American Indian resources of the site on local and regional perspectives; monitor and manage discovered cultural resources; and establish a worker education program. The archaeological field program consists of three pedestrian surveys: Survey 1 includes two EDBH seismic survey lines and the area within the exploratory shaft facility (ESF); Survey 2 includes the remainder of the site plus a 1/4 to 3/4-mi border area; and Survey 3 includes an assortment of offsite areas. The historical studies will identify and evaluate known and discovered historical sites and structures and the Native American Indian will identify and evaluate cultural and religious concerns expressed by Indian tribal groups. Prehistoric and historic sites will be evaluated to determine if they meet eligibility criteria for listing on the National Register of Historic Places. This site study plan describes the need for each study; its design and design rationale; analysis, management, and use of data; schedule of field activities; organization of field personnel and sample management; and quality assurance requirements. The cultural resource studies will provide data for satisfying the Programmatic Agreement, engineering design needs, and SRP requirements for permits and approvals, and for minimizing effects to any cultural properties discovered during site characterization. 75 refs., 10 figs., 2 tabs.

44716 **(BMI/ONWI/C—67) Air pollutant emission rates for sources at the Davis Canyon Repository site.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Battelle Columbus Div., OH (USA)). Nov 1985. Contract AC02-87CH10290. 222p. (BMI/ONWI—685). H. Order Number DE88013702/JAW.

This document summarizes the air-quality source terms used for the Davis Canyon, Utah environmental assessment report and explains their derivation. The engineering data supporting these source terms appear as appendixes to the report and include summary equipment lists for the repository (December, 1984) and detailed equipment lists for the exploratory shaft (June and July, 1985). Although substantial work has been performed in establishing the current repository design, a greater effort will be required for the final design. Consequently, the repository emission rates presented here should be considered as preliminary estimates. Another set of air pollutant emission rates will be calculated after design data are more firmly established. 19 refs., 18 tabs.

44717 **(BMI/ONWI/C—68) Site Study Plan for land use, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 71p. OSTI, PO Bx 62, Oak Ridge, TN 3783104. Order Number TI88013301/JAW.

The Land Use Site Study Plan describes a field program consisting of characterization of the site; seismic survey rights-of-way and transportation and utility corridors, the vicinity, the region, future land use, and monitoring land-use change. Aerial photography will be used to characterize the site, seismic rows and transportation and utility corridors, and the vicinity. The resulting land-use maps and overlays will then be verified in the field. Interviews with farm managers and local experts will provide additional information. A Geographic Information System (GIS) and satellite imagery will be used to characterize the region, monitor land-use change, and provide information to assist with the future land use study. The site study plan describes the study design and rationale, the filed data collection procedures and equipment, the data analysis methods and application of results, the data management strategy, the schedule of field activities, the personnel requirements and management of the study, and the study's quality assurance program. The directives and requirements that drive these studies are derived from the Salt Repository Project Requirements Document. 51 refs; 6 figs; 3 tabs.

44718 **(BMI/ONWI/C—71) Site Study Plan for meteorology/air quality, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 61p. H. Order Number TI88013298/JAW.

The Meteorological/Air Quality Site Study Plan describes a field program consisting of continuous measurements of surface (10-meter) wind speed and direction, temperature, humidity, dew point, pressure, and sensible heat flux (vertical). Air quality measurements will be limited to suspended particulate matter. After the first year of measurements, a 60-meter tower will be added to incorporate measurements needed for later modeling and dose calculations; these will include upper level winds, vertical temperature structure, and vertical wind speed. All of these measurements will be made at a site located within the 9-mi^2 site area but remote from the ESF. A second site, located near and downwind from the ESF, will monitor only particulate matter. The SSP describes the need for each study; its design and design rationale; analysis, management, and use of data, schedule of field activities, organization of field personnel and sample management, and quality assurance requirements. These studies will provide data needed to satisfy requirements contained in, or derived from the Salt Repository Project Requirements Document. 38 refs., 8 figs., 3 tabs.

44719 **(BMI/ONWI/C—72) Site Study Plan for salt, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 129p. H. Order Number TI88013296/JAW.

The Salt Site Study Plan (SSP) describes a program for characterizing the existing salt environment in the site vicinity. A step-by-step approach is described which proceeds from published data and planned theoretical studies, to planned laboratory studies, and finally to planned field studies, to provide the necessary data to meet program requirements contained in the Salt Repository Project - Requirements Document (SRP-RD). The plan also draws

on the results of other SSP's for certain data; for example, soil salinity data are to be provided under the Soils SSP. The salt studies consist of evaluation of control and mitigation measures, salt monitoring studies, emission factors development, air models development and validation, and risk assessment. For each study, its design and design rationale; analysis, management, and use of data; schedule of activities; organization of personnel and sample management; and quality assurance requirements are described. 90 refs., 9 figs., 7 tabs.

44720 **(BMI/ONWI/C—73) Site Study Plan for soils, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 87p. OSTI, PO Bx 62, Oak Ridge, TN 3783105. Order Number TI88013303/JAW.

The Soils Site Study Plan describes a field program consisting of a soil characterization survey, impact monitoring of soils, predisturbance soil salinity survey, and a reclamation suitability study. This information will be used to plan for soil stripping, stockpiling, and replacement; reclamation of soils; determining predisturbance chemical and physical characteristics of the soils; including salinity levels; and monitoring for changes in chemical and physical characteristics of the soil. The SSP describes for each study the need for the study, the study design, data management and use, schedule of proposed activities, and the quality assurance program. These studies will provide data needed to satisfy requirements contained in, or derived from, the Salt Repository Project Requirements Document. 75 refs., 10 figs., 5 tabs.

44721 **(BMI/ONWI/C—76) Draft At-Depth Study Plan for an exploratory shaft facility in salt: Revision 1.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Mar 1988. Contract AC02-87CH10290. 316p. H. Order Number DE88012837/JAW.

This draft At-Depth Study Plan describes a program of at-depth monitoring and testing in the bedded salt deposits of a candidate high-level nuclear waste repository site in Deaf Smith County, Texas. The test program will be undertaken within an At-Depth Facility (ADF) constructed at the candidate repository horizon. The purpose of the program is to assist with site characterization in support of determination of site suitability for development as a repository and for preparation of licensing documentation, and to provide information in support of repository design and performance assessment evaluation. The program includes a variety of geological, geophysical, geomechanical, thermochemical, and geohydrological monitoring and testing. The program is presented as a series of separate studies concerned with geological, geomechanical, and geohydrological site characterization, and with evaluating the mechanical and hydrological response of the site to construction of the ADF. The various studies, and associated test or monitoring methods, are included. Specific large-scale tests concerned with evaluating the performance of engineered components of the repository system (i.e., rooms, waste package, bulkhead and backfill seals) will be performed in the ADF but are described separately in individual Study Plan. 53 refs., 54 figs., 24 tabs.

44722 **(BMI/ONWI/C—81) Technical procedures for implementation of acoustics site studies, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1987. Contract AC02-87CH10290. 219p. H. Order Number TI88013294/JAW.

The purpose and scope of the technical procedure for processing data from the tethered meteorological system are covered. Definitions, interfaces, and concurrent data needs are also addressed. This technical procedure describes how to control, organize, verify, and archive tethered meteorological system data. These data will be received at the processing location from the field measurement location and are part of the characterization of the Deaf Smith County Site, Texas for the salt repository program. These measurements will be made in support of the sound propagation study and are a result of environmental data requirements for acoustics. 6 refs., 15 figs., 5 tabs.

44723 **(BMI/ONWI/C—84) Technical procedures for the implementation of cultural resource site studies, Deaf Smith County, Texas: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Harmsworth Associates, Laguna Hills, CA (USA)). 30 Sep 1987. Contract AC02-87CH10290. 337p. H. Order Number DE88013309/JAW.

Cultural resources at the Deaf Smith County site will be identified, evaluated and managed through the implementation of studies detailed in the Site Study Plan for Cultural Resources. This technical procedure outlines the conduct of pedestrian survey and the documentation of identified cultural resources. The purpose of the field surveys is to identify and document cultural resources in the areas that will be affected by site characterization activities and to record the environmental setting of identified cultural resources. Three pedestrian surveys will cover 100 percent of the on-site and off-site project areas. Survey 1 will provide coverage of the Repository Surface Facility (RSF) area, which includes the Exploratory Shaft Facility (ESF) and two linear engineering design borehole (EDBH) seismic survey corridors. Survey 2 will provide coverage of a 39 km^2 (15 mi^2) area that includes the 23 km^2 (9 mi^2) Deaf Smith County site plus a 0.4 to 0.8 kM (1/4 to 1/2 mi) border area but excludes the area covered by Survey 1. Survey 3 will cover offsite geotechnical test areas, such as the locations of playa boreholes, deep playa wells, hydrologic tests, site foundation borings, and their access routes. The purpose of site documentation or recording is to address the project information needs for land use permits and approvals, engineering design support, and cultural resource evaluation for National Register of Historic Places eligibility. Site documentation will consist of gathering sufficient data on identified resources to complete Texas Natural Resource Information System (TNRIS). 7 refs., 3 figs.

44724 **(BMI/ONWI/C—95) Technical procedures for implementation of meteorology/air quality site studies, Deaf Smith County site, Texas: Environmental Field Program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1987. Contract AC02-87CH10290. 464p. H. Order Number DE88013297/JAW.

This report describes The Technical Procedures that will be used to monitor air quality and meteorology. Topics include: high-volume filter handling; operation, maintenance, and calibration of the 10-M meteorological and air quality system; processing data from the 10-M meteorological tower; processing data from the 60-M meteorological tower; processing total suspended particulate filters and data from the high-volume air samplers; operation maintenance, and calibration of the 60-M meteorological and air quality system; and auditing the air quality system. 4 refs., 6 figs.

44725 **(BMI/ONWI/C—99(1)) Technical procedures for water resources, Deaf Smith County site, Texas: Volume 1: Environmental Field Program: Final draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Morrison-Knudsen Engineers, Inc., Denver, CO (USA)). Aug 1987. Contract AC02-87CH10290;AC02-83CH10140. 434p. H. Order Number TI88014278/JAW.

This volume contains Technical Procedures pursuant to the Water Resources Site Study Plan including, determination of basin topographic characteristics, determination of channel and playa lake characteristics, operation of a stream gaging station, operation of a playa lake stage gaging system, and processing of data from a playa lake stage gaging system.

44726 **(BMI/ONWI/C—99(3)) Technical procedures for water resources: Volume 3, Environmental Field Program, Deaf Smith County Site, Texas: Final draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Morrison-Knudsen Engineers, Inc., Denver, CO (USA)). Aug 1987. Contract AC02-87CH10290. 332p. H. Order Number TI88014266/JAW.

To ensure that the environmental field program comprehensively addresses the issues and requirements of the project, a site study plan (SSP) has been prepared for Water Resources (ONWI, 1987). This technical procedure (TP) has been developed to imple-

ment the field program described in the Water Resources Site Study Plan. This procedure provides the general method for the field collection of water and sediment samples from playa lakes using an Alpha horizontal type sampler or equivalent or a peristaltic pump for water and a KB-coring devise or ponar grab for sediments. The samples will be preserved and then shipped to a laboratory for analysis. The water quality and sediment samples will be collected as part of the surface-water quality field study described in the Site Plan for Water Resources. 15 refs., 5 figs., 3 tabs.

44727 **(BMI/ONWI/C—102) An approach to selecting routes over which to transport excess salt from the Deaf Smith County Site.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1987. Contract AC02-87CH10290. 54p. H. Order Number TI88012378/JAW.

This report presents an approach to be utilized in the identification of rail and/or highway routes for the disposal of waste salt and other salt contaminated material from repository construction. Relevant issues regarding salt transport also are identified. The report identifies a sequence of activities that precede actual route selection, i.e., final selection of a salt disposal method and its location, refined estimates of salt shipment volume and schedule, followed by selection of rail or truck or a combination thereof, as the preferred transport mode. After these factors are known, the route selection process can proceed. Chapter 2.0 of this report identifies directives and requirements that potentially could affect salt transport from the Deaf Smith site. A summary of salt disposal alternatives and reference cases is contained in Chapter 3.0. Chapter 4.0 identifies and discusses current methods of salt handling and transport in the United States, and also provides some perspective as to the volume of excess salt to be transported from the Deaf Smith site relative to current industry practices. Chapter 5.0 identifies an approach to the salt transportation issue, and suggests one system for evaluating alternative highway routes for truck shipments.

44728 **(BMI/ONWI/C—109) SRP [Salt Repository Project] configuration management plan.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 29 May 1987. Contract AC02-87CH10290. 37p. OSTI, PO Bx 62, Oak Ridge, TN 3783103. Order Number TI88013697/JAW.

This configuration management plan describes the organization, policies, and procedures that will be used on the Salt Repository Project (SRP) to implement the configuration management disciplines and controls. Configuration management is a part of baseline management. Baseline management is defined in the SRP Baseline Procedures Notebook and also includes cost and schedule baselines. Configuration management is a discipline applying technical and administrative direction and surveillance to identify and document the functional and physical characteristics of an item, to control changes to those characteristics, to record and report change processing and implementation status, and to audit the results. Configuration management is designed as a project management tool to determine and control baselines, and ensure and document all components of a project interface both physically and functionally. The purpose is to ensure that the product acquired satisfies the project's technical and operational requirements, and that the technical requirements are clearly defined and controlled throughout the development and acquisition process. 5 figs.

44729 **(BMI/ONWI/C—111) Faulting in the Matador Uplift area, Texas: Topical report.** Regan, T.R.; Murphy, P.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stone and Webster Engineering Corp., Boston, MA (USA)). Aug 1987. Contract AC02-87CH10290;AC02-87CH10285;AC02-83CH10140. 172p. (ONWI/SUB—87-E512-05000-T48). H. Order Number TI88013688/JAW.

Location, apparent vertical displacement, and latest detectable movement have been interpreted for 103 faults identified in the Matador Uplift area of Texas. The interpretations are based on lithostratigraphic correlations using geophysical logs and sample logs from 1,208 wells across 12 counties. The stratigraphic interval studied extends from crystalline basement (Precambrian) to the Alibates Formation (Upper Permian). Most of the faults strike northwest or east-northeast, have near vertical dips, and bound a series of upthrown and downthrown blocks along the east-west trending Uplift. Horizontal displacements were not determined. The maximum vertical displacement observed is nearly 4,500 ft (1,400 m), with maximum offsets on individual faults commonly in the 1,000 ft (300 m) to 2,000 ft (610 m) range. About half of the faults extend into the Lower Permian section, and at least 17 of these offset the Upper Permian Alibates Formation. The structural relief of the Matador Uplift is not as great as depositional patterns and local facies distributions. Lithologic transitions across the Uplift contribute to the uncertainty of structural interpretations. 66 refs., 33 figs., 2 tabs.

44730 **(BMI/ONWI/C—117) Salt Repository Project waste emplacement mode decision paper: Revison 1.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Aug 1987. Contract AC02-87CH10290. 45p. H. Order Number TI88013698/JAW.

This paper provides a recommendation as to the mode of waste emplacement to be used as the current basis for site characterization activity for the Deaf Smith County, Texas, high level nuclear waste repository site. It also presents a plan for implementing the recommendation so as to provide a high level of confidence in the project's success. Since evaluations of high-level waste disposal in geologic repositories began in the 1950s, most studies emplacement in salt formations employed the vertical orientation for emplacing waste packages in boreholes in the floor of the underground facility. This orientation was used in trials at Project Salt Vault in the 1960s. The Waste Isolation Pilot Plant (WIPP) has recently settled on a combination of vertical and horizontal modes for various waste types. This paper analyzes the information available and develops a project position upon which to base current site characterization activities. The position recommended is that the SRP should continue to use the vertical waste emplacement mode as the reference design and to carry the horizontal mode as a "passive" alternative. This position was developed based upon the conclusions of a decision analysis, risk assessment, and cost/schedule impact assessment. 52 refs., 6 figs., 1 tab.

44731 **(BMI/ONWI/C—118(1)-Rev.0) Design parameters and source terms: Volume 1, Design parameters: Revision 0.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Oct 1987. Contract AC02-87CH10290;AC02-83WM46656. 401p. H. Order Number DE88013737/JAW.

The Design Parameters and Source Terms Document was prepared in accordance with DOE request and to provide data for the environmental impact study to be performed in the future for the Deaf Smith County, Texas site for a nuclear waste repository in salt. This document updates a previous unpublished report by Stearns Catalytic Corporation (SCC), entitled "Design Parameters and Source Terms for a Two-Phase Repository in Salt," 1985, to the level of the Site Characterization Plan - Conceptual Design Report. The previous unpublished SCC Study identifies the data needs for the Environmental Assessment effort for seven possible Salt Repository sites.

44732 **(BMI/ONWI/C—118(3)-Rev.0) Design parameters and source terms: Volume 3, Source terms.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Oct 1987. Contract AC02-83WM46656;AC02-87CH10290. 372p. H. Order Number DE88013735/JAW.

The Design Parameters and Source Terms Document was prepared in accordance with DOE request and to provide data for the environmental impact study to be performed in the future for the Deaf Smith County, Texas site for a nuclear waste repository in salt. This document updates a previous unpublished report by Stearns Catalytic Corporation (SCC), entitled "Design Parameters and Source Terms for a Two-Phase Repository in Salt," 1985, to the level of the Site Characterization Plan - Conceptual Design Report. The previous unpublished SCC Study identifies the data needs for the Environmental Assessment effort for seven possible Salt Repository sites. 11 refs., 9 tabs.

44733 (BMI/ONWI/C—121) ESF [Exploratory Shaft Facility].Title II 60% interim design review findings report:. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Oct 1987. Contract AC02-87CH10290. 734p. H. Order Number DE88013738/JAW.

This Interim Design Review Findings Report contains the results of the review, the Design Review Board (DRB) conclusions and recommended future actions, the technical checklist, and required supporting documentation. Brief descriptions of the major issues raised during the 60% design review are: a definite need for greater ICWG participation and active direction in the design process; approval and issuance of the ESF Vulnerability Study; inclusion of an alternative to concrete blocks in the design of the preliminary liner in salt; development of achievable excavation specifications and criteria to be used during shaft sinking; development of ground support plan that is flexible to the needs of the testing requirements; decision to either retain or eliminate shaft liner "D" in the lower salt section of the shafts and decision to either retain or eliminate mechanical cooling of the ESF underground ventilation air.

44734 (BMI/ONWI/C—123) Aquifer treatment: Final report. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Mar 1988. Contract AC02-87CH10290;AC02-83WM46656. 252p. H. Order Number TI88013699/JAW.

The strata between the surfaces and the repository horizon at each of three proposed sites for a geologic repository for high-level nuclear waste contain one or more aquifers of varying productivity. Since one of the greatest impediments to safety and efficient operations in shaft sinking would be the inflow of large volumes of water, it is imperative that various methods of aquifer treatment to control this inflow be investigated. The US Department of Energy (DOE) has specified that three primary methods of aquifer treatment be evaluated: pregrouting, formation freezing, and depressurization. These methods were evaluated in separate studies which are included in this report as separate sections. The investigations of these methods and how each could be applied to the three proposed sites are described. Data on site conditions and conclusions resulting from the three investigations were considered in the final recommendations are presented in this report. The recommendations include various combinations of pregrouting, formation freezing, and depressurization. 85 refs., 65 figs., 17 tabs.

44735 (BMI/ONWI/C—126) Draft Automatic Data Acquisition System Plan. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Apr 1987. Contract AC02-87CH10290. 187p. H. Order Number TI88013733/JAW.

This Automatic Data Acquisition System (ADAS) Plan has been prepared in support of the requirement for detailed site characterization of the Deaf Smith County candidate repository site in salt, and describes the data acquisition system which will be used for unattended data collection from the geotechnical instrumentation installed at the site. Section 1.1 discusses the programmatic background to the plan, Section 1.2 presents the scope and purpose of the plan, and the organization of the document is given in Section 1.3. 31 refs., 34 figs., 8 tabs.

44736 (BMI/ONWI/C—128) Site study plan for EDBH [Engineering Design Boreholes] seismic surveys, Deaf Smith County site, Texas: Revision 1. Hume, H. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Dec 1987. Contract AC02-87CH10290. 60p. H. Order Number DE88014260/JAW.

This site study plan describes seismic reflection surveys to run north-south and east-west across the Deaf Smith County site, and intersecting near the Engineering Design Boreholes (EDBH). Both conventional and shallow high-resolution surveys will be run. The field program has been designed to acquire subsurface geologic and stratigraphic data to address information/data needs resulting from Federal and State regulations and Repository program requirements. The data acquired by the conventional surveys will be common-depth- point, seismic reflection data optimized for reflection events that indicate geologic structure near the repository horizon. The data will also resolve the basement structure and shallow reflection events up to about the top of the evaporite sequence. Field acquisition includes a testing phase to check/select parameters and a production phase. The field data will be subjected immediately to conventional data processing and interpretation to determine if there are any anamolous structural for stratigraphic conditions that could affect the choice of the EDBH sites. After the EDBH's have been drilled and logged, including vertical seismic profiling, the data will be reprocessed and reinterpreted for detailed structural and stratigraphic information to guide shaft development. The shallow high-resulition seismic reflection lines will be run along the same alignments, but the lines will be shorter and limited to immediate vicinity of the EDBH sites. These lines are planned to detect faults or thick channel sands that may be present at the EDBH sites. 23 refs. , 7 figs., 5 tabs.

44737 (BMI/ONWI/C—129) Avery Island core aging and storage effects study: Topical report. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Earth Technology Corp., Long Beach, CA (USA)). Jul 1987. Contract AC02-87CH10290;AC02-83CH10140. 382p. H. Order Number TI88014274/JAW.

A 1-year program of rock property measurements was conducted to assess the possible influences of core aging and shipping, handling, and storage conditions on the hydrothermomechanical properties of domal salt. Core samples collected from the Avery Island mine were randomly assigned to one of several age groups within two test series to be shipped/handled/stored under carefully controlled or under conventional, less well-controlled conditions, respectively. Sets of test measurements were made on specimens of each age group within each series and provided an extensive data base on the stress-strain behavior, compressional wave velocity, electrical resistivity, pore fluid permeability, thermal conductivity, moisture content, and petrofabric features of these samples as a function of age and storage/handling conditions. A substantial increase in predeformation permeability with core age was observed that provides one potentially significant indication of an aging effect. In addition, an apparent trend of decreasing moisture content with increasing age was noted for samples stored/handled under conventional conditions. Except for these effects, however, no data trends were observed that indicate the influence of either core age or storage/handling conditions on the measured behavior of domal salt. 18 refs., 8 figs., 1 tab.

44738 (BMI/ONWI/C—130) Basic repository environment assessment design basis, Cypress Creek Dome Site. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1988. Contract AC02-87CH10290. 175p. H. Order Number TI88014279/JAW.

This study examines the engineering factors and costs associated with the construction, operation, and decommissioning of a high-level nuclear waste repository in salt in the Gulf Interior Region at Cypress Creek Cone, Mississippi. The study assumes a repository capacity of 36,000 metric tons of heavy metal (MTHM) of unreprocessed spent fuel and 36,000 MTHM of commercial high-level reprocessing waste, along with 7020 canisters of defense high-level reprocessing waste and associated quantities of remote- and contact-handled transuranic waste (TRU). With the exception of TRU, all the waste forms are placed in 300- to 1000-year-life carbon-steel waste packages in a collocated waste handling and packaging facility (WHPF), which is also described. The construction, operation, and decommissioning of the proposed repository is estimated to cost approximately $4.66 billion. Costs include those for the collocated WHPF, engineering, and contingency, but exclude waste from assembly and shipment to the site and waste package fabrication and shipment to the site. These costs reflect the relatively easy access to the site. Construction would require an estimated 7 years. Engineering factors and costs are not strongly influenced by environmental considerations. 53 refs., 24 figs., 10 tabs.

44739 **(BMI/ONWI/C—131) Basic repository environmental assessment design basis, Davis Canyon site.** (Stearns Catalytic Corp., Denver, CO (USA)). 1984. Contract AC02-87CH10290. 225p. OSTI, PO Bx 62, Oak Ridge, TN 3783110. Order Number DE88013313/JAW.

This study examines the engineering factors and costs associated with the construction, operation, and decommissioning of a high-level nuclear waste repository in salt in the Paradox Basin in Davis Canyon, Utah. The study assumes a repository capacity of 36,000 metric tons of heavy metal (MTHM) of unreprocessed spent fuel and 36,000 MTHM of commercial high-level reprocessing waste, along with 7,020 canisters of defense high-level reprocessing waste and associated quantities of remote- and contact-handled transuranic waste (TRU). With the exception of TRU, all the waste forms are placed in 300- to 1,000-year-life carbon-steel waste packages in a collected waste handling and packaging facility (WHPF), which is also described. The construction, operation, and decommissioning of the proposed repository is estimated to cost approximately $5.49 billion. Costs include those for the collocated WHPF, engineering, and contingency, but exclude waste form assembly and shipment to the site and waste package fabrication and shipment to the site. These costs reflect the relative average wage rates of the region and the relatively sound nature of the salt at this site. Construction would require an estimated 7.75 years. Engineering factors and costs are not strongly influenced by environmental considerations. 50 refs., 24 figs., 20 tabs.

44740 **(BMI/ONWI/C—132) Basic repository environmental assessment design basis, Lavender Canyon site.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). [1988]. Contract AC02-87CH10290. 226p. H. Order Number TI88014265/JAW.

This study examines the engineering factors and costs associated with the construction, operation, and decommissioning of a high-level nuclear waste repository in salt in the Paradox Basin in Lavender Canyon, Utah. The study assumes a repository capacity of 36,000 metric tons of heavy metal (MTHM) of unreprocessed spent fuel and 36,000 MTHM of commercial high-level reprocessing waste, along with 7020 canisters of defense high-level reprocessing waste and associated quantities of remote- and contact-handled transuranic waste (TRU). With the exception of TRU, all the waste forms are placed in 300- to 1000-year-life carbon-steel waste packages in a collocated waste handling and packaging facility (WHPF), which is also described. The construction, operation, and decommissioning of the proposed repository is estimated to cost approximately $5.51 billion. Costs include those for the collocated WHPP, engineering, and contingency, but exclude waste form assembly and shipment to the site and waste package fabrication and shipment to the site. These costs reflect the relative average wage rates of the region and the relatively sound nature of the salt at this site. Construction would require an estimated 7.75 years. Engineering factors and costs are not strongly influenced by environmental considerations. 51 refs., 24 figs., 20 tabs.

44741 **(BMI/ONWI/C—133) Basic repository environmental assessment design basis, Vacherie Dome site.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). 1988. Contract AC02-87CH10290. 177p. H. Order Number TI88014267/JAW.

This study examines the engineering factors and costs associated with the construction, operation, and decommissioning of a high-level nuclear waste repository in salt in the Gulf Interior Region at Vacherie Dome near Minden, Louisiana. The study assumes a repository capacity of 36,000 metric tons of heavy metal (MTHM) of unreprocessed spent fuel and 36,000 MTHM of commercial high-level reprocessing waste, along with 7,020 canisters of defense high-level reprocessing waste and associated quantities of remote- and contact-handled transuranic waste (TRU). With the exception of TRU, all the waste forms are placed in 300- to 1,000-year-life carbon-steel waste packages in a collocated waste handling and packaging facility (WHRF), which is also described. The construction, operation, and decommissioning of the proposed repository is estimated to cost approximately $4.89 billion. Costs include those for the collocated WHRF, engineering, and contingency, but exclude waste form assembly and shipment to the site and waste package fabrication and shipment to the site. These costs reflect the relative average wage rates of the region and the relatively easy access to the site. Construction would require an estimated 6.75 years. Engineering factors and costs are not strongly influenced by environmental considerations. 51 refs., 3 figs., 20 tabs.

44742 **(BMI/ONWI/C—135) Basic repository environmental assessment design basis, Richton Dome site.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). 1988. Contract AC02-87CH10290. 179p. H. Order Number DE88014256/JAW.

This study examines the engineering factors and costs associated with the construction, operation, and decommissioning of a high-level nuclear waste repository in salt in the Gulf Interior Region at Richton Dome in Perry County, Mississippi. The study assumes a repository capacity of 36,000 metric tons of heavy metal (MTHM) of unreprocessed spent fuel and 36,000 MTHM of commercial high-level reprocessing waste, along with 7,020 canisters of defense high-level reprocessing waste and associated quantities of remote-and contact-handled transuranic waste (TRU). With the exception of TRU, all the waste forms are placed in 300- to 1,000-year-life carbon-steel waste packages in a collocated waste handling and packaging facility (WHPF), which is also described. The construction, operation, and decommissioning of the proposed repository is estimated to cost approximately $4.49 billion. Costs include those for the WHPF, engineering, and contingency, but exclude waste form assembly and shipment to the site and waste package fabrication and shipment to the site. These costs reflect the relative average wage rates of the region and the relatively easy access to the site. Construction would require an estimated 6.25 years. Engineering factors and costs are not strongly influenced by environmental considerations. 52 refs., 24 figs., 20 tabs.

44743 **(BMI/ONWI/C—136) Basic repository source term and data sheet report, Cypress Creek Dome: Draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). [1988]. Contract AC02-87CH10290. 75p. H. Order Number TI88014255/JAW.

This report is one of a series describing studies undertaken in support of the US Department of Energy Civilian Radioactive Waste Management (CRWM) Program. This study contains the derivation of values for environmental source terms and resources consumed for a CRWM repository. Estimates include heavy construction equipment; support equipment; shaft-sinking equipment; transportation equipment; and consumption of fuel, water, electricity, and natural gas. Data are presented for construction and operation at an assumed site in Cypress Creek Dome, Mississippi. 2 refs., 6 tabs.

44744 **(BMI/ONWI/C—138) Basic repository source term and data sheet report: Vacherie Dome:.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). [1988]. Contract AC02-87CH10290. 75p. H. Order Number TI88014258/JAW.

This report is one of a series describing studies undertaken in support of the US Department of Energy Civilian Radioactive Waste Management (CRWM) Program. This study contains the derivation of values for environmental source terms and resources consumed for a CRWM repository. Estimates include heavy construction equipment; shaft-sinking equipment; transportation equipment; and consumption of fuel, water, electricity, and natural gas. Data are presented for construction and operation at an assumed site in Vacherie Dome, Louisiana. 3 refs., 6 tabs.

44745 **(BMI/ONWI/C—139) Basic repository source term and data sheet report: Lavender Canyon.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). 1988. Contract AC02-87CH10290. 75p. H. Order Number TI88014272/JAW.

This report is one of a series describing studies undertaken in support of the US Department of Energy Civilian Radioactive Waste Management (CRWM) Program. This study contains the derivation of values for environmental source terms and resources consumed for a CRWM repository. Estimates include heavy construction equipment; support equipment; shaft-sinking equipment; transportation equipment; and consumption of fuel, water, electricity, and natural gas. Data are presented for construction and operation at an assumed site in Lavender Canyon, Utah. 3 refs; 6 tabs.

44746 (BMI/ONWI/C—140) Basic repository source term and data sheet report: Swisher County. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stearns Catalytic Corp., Denver, CO (USA)). 1988. Contract AC02-87CH10290. 75p. H. Order Number TI88014273/JAW.

This report is one of a series describing studies undertaken in support of the US Department of Energy Civilian Radioactive Waste Management (CRWM) Program. This study contains the derivation of values for environmental source terms and resources consumed for a CRWM repository. Estimates include heavy construction equipment; support equipment; shaft-sinking equipment; transportation equipment; and consumption of fuel, water, electricity, and natural gas. Data are presented for construction and operation at an assumed site in Swisher County, Texas. 2 refs., 6 tabs.

44747 (BMI/ONWI/C—145) Conceptual designs for waste packages for horizontal or vertical emplacement in a repository in salt for reference in the site characterization plan. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1987. Contract AC02-87CH10290. 224p. H. Order Number TI88014263/JAW.

This report includes the options of horizontal and vertical emplacement, the addition of a phased repository, an additional waste form (intact spent fuel), revised geotechnical data appropriate for the Deaf Smith County site, new corrosion data for the container, and new repository design data. The waste package consists of waste form and canister within a thick-walled, low-carbon steel container surrounded by packing. The container is a hollow cylinder with a flat head welded to each end. The design concepts for the waste container or vertical and horizontal emplacement are identical. This report discusses the results of analyses of aspects of the reference waste package concept needing changes because of new data and information believed applicable to the Deaf Smith County site. Included are waste package conceptual designs or (1) the reference defense high-level waste form from the Savannah River Plant; (2) intact spent fuel with our pressurized-water-reactor or nine boiling-water-reactor assemblies per package for emplacement during Phase 1 of repository operation; and (3) spent fuel which has been disassembled and consolidated into a segmented cylindrical canister with rods from either 12 pressurized-water-reactor or 30 boiling-water-reactor assemblies per package for emplacement during Phase 2. 30 refs., 61 figs., 30 tabs.

44748 (BMI/ONWI/C—147) Documentation of SPECTROM-41: A finite-element heat transfer analysis. Svalstad, D.K. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; RE/SPEC, Inc., Albuquerque, NM (USA)). Jun 1985. Contract AC02-87CH10290. 821p. H. Order Number TI88014283/JAW.

SPECTROM-41 is a finite element heat transfer computer program that was developed specifically for the analysis of thermal problems related to the disposal of nuclear waste. The code is an integral part of the SPECTROM (Special Purpose Engineering Codes for Thermal /ROck Mechanics) series of special purpose finite element programs that is continually being developed by RE/SPEC Inc. (RSI) to address the many unique rock mechanics problems resulting from the storage of radioactive waste in geologic formations. This document presents the theoretical basis for the mathematical mode. the finite element formulation of the program, a description of the input data for the program, along with details about program support and continuing documentation. The principal component model employed in the program is based on the Fourier law of conductance. Numerous program options provide the capability of considering various boundary conditions, material stratification and anisotropy, and time-dependent heat generation that are characteristic of problems involving the disposal of nuclear waste in a geologic formation. Numerous verification problems are included in the documentation in addition to highlights of past and ongoing verification and validation efforts. A typical repository problem is solved using SPECTROM-41 to exemplify the use of the program in addressing problems related to the disposal of nuclear waste. 4 refs., 2 figs., 4 tabs.

44749 (BMI/ONWI/C—148) Experimental modeling of diapirs, Parts 1 and 2: Final report. Jackson, M.P.A.; Cornelius, R.R.; Talbot, C.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Texas Univ., Austin (USA). Bureau of Economic Geology). 1988. Contract AC02-87CH10290. 315p. H. Order Number TI88014253/JAW.

The manner in which sedimentary overburden accumulates significantly influences the growth of syndepositional salt structures. To determine the general principles of this influence for application to specific instances in nature, we carried out 16 experiments using scaled centrifuged models to simulate the effect of variable sedimentary loading on the geometry, kinematics, and dynamics of syndepositional salt structures. This topic has been almost entirely ignored in both material and mathematical modeling of salt structures. The rheology of four modeling materials was determined. The equivalent shear viscosity of terrigenous clastic overburdens in the Mesozoic section of a Gulf Coast interior basin and in the Pleistocene section of the northern Gulf of Mexico was estimated by dynamic scaling to be 5×10^{20} Pa{center←dot}s and 3×10^{20} Pa{center←dot}s, respectively; the equivalent viscosity of Mesozoic Gulf Coast carbonates was estimated to be 2×10^{21} Pa{center←dot}s. 95 refs., 67 figs., 7 tabs.

44750 (BMI/ONWI/C—154) Core logging test procedure. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). 26 May 1986. Contract AC02-87CH10290. 27p. H. Order Number DE88014262/JAW.

Core logging and sampling will be undertaken for all cored boreholes within the Exploratory Shaft Facility (ESF). These boreholes will be drilled primarily for the purpose of hydrologic testing, downhole mechanical/thermal testing, and for the placement of instrumentation. Core logging and sampling will assist in overall site characterization and provide geologic information at the specific sites where testing will occur. This activity will aid in the confirmation of the stratigraphy and structure of the host rock beyond the limits of the excavation. This document provides a description of the required procedures for core logging and sampling within the ESF. Qualified technical personnel, using these procedures, will collect the required core descriptions and samples. 3 refs., 4 figs.

44751 (BMI/ONWI/C—156) Current position on software for the automatic data acquisition system. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). 1988. Contract AC02-87CH10290. 78p. OSTI, PO Bx 62, Oak Ridge, TN 37831- Available form OSTI.. Order Number TI88014276/JAW.

This report describes the current concepts for software to control the operation of the Automatic Data Acquisition System (ADAS) proposed for the Deaf Smith County, Texas, Exploratory Shaft Facility (ESF). The purpose of this report is to provide conceptual details of how the ADAS software will execute the data acquisition function, and how the software will make collected information available to the test personnel, the Data Management Group (DMG), and other authorized users. It is not intended that this report describe all of the ADAS functions in exact detail, but the concepts included herein will form the basis for the formal ADAS functional requirements definition document. 5 refs., 14 figs.

44752 (BMI/ONWI/C—160) The CFEST-INV stochastic hydrology code: Mathematical formulation, application, and user's manual. Devary, J.L. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; ICF Northwest, Richland, WA (USA)). Jun 1987. Contract AC02-87CH10290. 266p. H. Order Number DE88013291/JAW.

Performance assessments of a nuclear waste repository must consider the hydrologic, thermal, mechanical, and geochemical environments of a candidate site. Predictions of radionuclide transport requires estimating water movement as a function of pressure, temperature, and solute concentration. CFEST (Coupled Fluid, Energy, and Solute Transport), is a finite-element based groundwater code that can be used to simultaneously solve the partial differential equations for pressure head, solute temperature, and solute concentration. The CFEST code has been designed to support site, repository, and waste package subsystem assessments. CFEST-INV is a stochastic hydrology code that was developed to augment the CFEST code in data processing; model calibration; performance prediction; error propagation; and data collection guidance. The CFEST-INV code utilizes kriging, finite-element modeling, adjoint-sensitivity, statistical-inverse, first-order variance, and Monte-Carlo techniques to develop performance (measure) driven data collection schemes and to determine the waste isolation capabilities (including uncertainties) of candidate repository sites. This report contains the basic physical and numerical principles of the CFEST-INV code, its input parameters, verification exercises, a user's manual, and the code's application history. 18 refs., 16 figs., 6 tabs.

44753 (BMI/ONWI/C—161) Dissolution of the Upper Seven Rivers and Salado salt in the interior Palo Duro Basin, Texas: Revision: Topical report. DeConto, R.T.; Murphy, P.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stone and Webster Engineering Corp., Boston, MA (USA)). Sep 1987. Contract AC02-87CH10290;AC02-83CH10140. 152p. (ONWI/SUB—87/E512-05000-T45). H. Order Number TI88013290/JAW.

The Upper Seven Rivers and Salado Formations contain the uppermost salts within the interior Palo Duro Basin, Stratigraphic and structural evidence based on geophysical well logs indicate that both dissolution and facies change have influenced the thickness of these uppermost salts. The magnitude of vertical salt loss due to dissolution is interminable at this time because original salt thickness is unknown. Gradual thinning of the Upper Seven Rivers Formation is recognized from south to north across the Palo Duro Basin. Anhydrites within the formation pinch out toward the basin margins, indicating that section loss is in part depositionally controlled. Additionally, informal subdivision of the Upper Seven Rivers Formation suggests that salt dissolution has occurred in the uppermost salt. A northeast-trending zone of thin Upper Seven Rivers Formation in portions of Deaf Smith, Randall, Castro, and Parmer Counties is possibly related to Tertiary dissolution. In New Mexico, local thinning of the Upper Seven Rivers Formation may be associated with faulting. Triassic erosion on uplifted fault blocks has affected the Upper Permian section. The Salado salt margin is located within the interior Palo Duro Basin. Geophysical well logs and core evidence indicate that the salt margin has migrated basinward as a result of dissolution. Permian dissolution probably contributed to some salt loss. 106 refs., 31 figs., 2 tabs.

44754 (BMI/ONWI/C—163) Origins of the Salado, Seven Rivers, and San Andres salt margins in Texas and New Mexico: Revision 1: Topical report. Boyd, S.D.; Murphy, P.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stone and Webster Engineering Corp., Boston, MA (USA)). Feb 1987. Contract AC02-87CH10290;AC02-83CH10140;AC02-87CH10285. 202p. (ONWI/SUB—87-E512-05000-T27). H. Order Number TI88013686/JAW.

The present boundaries of the San Andres, Seven Rivers, and Salado salts generally lie along the periphery of the Palo Duro and Tucumcari Basins. Various geologic mechanisms occurring singularly or in combination determined the positions of the salt margins. These mechanisms include nondeposition of salt and syndepositional and postdepositional dissolution. In New Mexico, San Andres units pinch out against the Pedernal and Sierra Grande Uplifts, indicating that nondeposition established the original salt margins there. Syndepositional dissolution of exposed Upper San Andres salts occurred in response to Guadalupian upwarp of the basin margins. Triassic erosion differentially removed Permian salt-bearing formations along the uplifts. Late Tertiary dissolution is indicated by fill of north-south trending collapse valleys. In Texas, Guadalupian upwarp along the Amarillo Uplift caused pinchout of Units 2 and 3 in the Lower San Andres and influenced the deposition of subsequent salt-bearing strata. The discontinuity of Upper San Andres evaporites across the Amarillo Uplift suggests syndepositional dissolution. Along the eastern and northeastern basin margin, dissolution may have accompanied Triassic erosion of locally uplifted Upper Permian strata. Tertiary dissolution is recognized beneath anomalously thick Ogallala Formation sections that overlie collasped Permian strata. 49 refs., 31 figs., 2 tabs.

44755 (BMI/ONWI/C—165) Drilling supervision procedure for the Exploratory Shaft Facility: Final draft. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Nov 1986. Contract AC02-87CH10290. 14p. H. Order Number TI88014264/JAW.

Drilling supervision will be undertaken in the Exploratory Shaft Facility (ESF) for boreholes drilled primarily for the purpose of hydrologic testing, downhole mechanical/thermal testing, sampling for laboratory testing, and for the placement of instrumentation. The primary purpose of this procedure is documentation of drilling activities prescribed by other procedures. Supervision of drilling includes designation of positions of authority, lines of communication, and methodology of supervising, monitoring, and documenting drilling and associated activities. The rationale for the specific applications of core drilling is provided by the test procedures for each activity. 2 figs.

44756 (CEGB-TPRD/B—0951/R87) Potential significance of microbial activity in radioactive waste disposal. McCabe, A.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Dec 1987. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754265/JAW.

The aim of this report is to assess the potential significance of microbial activity in radioactive waste disposal. It outlines the major factors which need to be considered in order to evaluate the importance of microbiological action. These include water and nutritional sources (particularly carbon) hostile conditions (particularly the effects of radiation and pH), the establishment of pH microenvironments and the degradative effect of microbial metabolic byproducts on the disposed waste forms. Before an active microbial population can develop there are certain basic requirements for life. These are outlined and the possibility of colonisation occurring within the chemical, radiological and nutritional constraints of a repository are considered. Once colonisation is assumed, the effect of microbial activity is discussed under five headings, i.e. (i) direct attack, (ii) physical disruption (which includes consideration of fissuring processes and void formation), (iii) gas generation (which may be of particular importance), (iv) radionuclide uptake and finally (v) alteration of groundwater chemistry. Particular attention is paid to the possibility of environments becoming established both within the waste form itself (allowing microbes to attack from the inside of the repository outward) or attack on the encapsulant materials (microbes attacking from the outside inward).

44757 (CONF-870859—Exec.Summ.) Proceedings of the ninth annual DOE low-level waste management forum: Executive summary, Technical and special session summaries, Attendees. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88013150/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

The Ninth Annual DOE Low-Level Waste Management Conference was held in Denver, Colorado; 312 persons attended. The Conference began with an opening plenary session, followed by six concurrent topical sessions addressing issues associated with disposal technology and facility development, waste characterization and verification, institutional and regulatory concerns, site clo-

sure and stabilization, and waste treatment. Two special technical sessions were also conducted. Significant results from each respective session follow. In his keynote address, Mark McClellan, Deputy Secretary for Environmental Protection in Pennsylvania's Department of Environmental Resources, discussed steps essential to successful commercial site selection and development. Troy E. Wade, II, DOE acting Assistant Secretary for Defense Programs, presented a second keynote address, discussing the future for the Department of Energy's Low-Level Waste Management Program. Mr. Wade congratulated the Low-Level Waste Management Program on achievements to date and emphasized the need to establish public confidence in the ability of the waste management community to manage wastes safely.

44758 **(CONF-870859—Pt.1) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 1, Disposal technology and facility development.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88013144/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This volume contains 16 reports on low-level radioactive waste disposal techniques and associated management concepts. Topics include design and construction of facilities, long-term management strategies, barrier systems, alternative technologies, mixed waste facilities, and the use of slag in liquid waste solidification. (TEM)

44759 **(CONF-870859—Pt.2) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 2, Institutional and regulatory issues.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013145/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This document contains 10 reports on the regulatory aspects of low-level radioactive waste management. Topics include public opinion, regulations, impacts of state government, risk assessment, economic aspects of regulations, annd changes in policy for activities that produce large quanities of radioactive wastes. (TEM)

44760 **(CONF-870859—Pt.3) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 3, Performance assessment.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88013146/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This document contains 14 reports on the performance assessment aspects of low-level radioactive waste disposal. Topics include performance assessment studies at waste sites, engineering projects, confinement barriers, waste forms and lysimeters. (TEM)

44761 **(CONF-870859—Pt.4) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 4, Waste characterization and verification.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013147/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This document contains seven reports on the characterization of waste streams from DOE Facilities. Topics include a classification system for waste forms, a disposal system for Iodine-129, a characterization system for waste streams, and a list of information needs. (TEM)

44762 **(CONF-870859—Pt.5) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 5, Site stabilization and closure.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013148/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This document contains seven reports describing techniques for decommissioning and long-term maintenance of low-level radioactive waste disposal sites. Topics include long-term stability for waste sites, remedial action sites, management objectives, and closure plans for various DOE sites. (TEM)

44763 **(CONF-870859—Pt.6) Proceedings of the ninth annual DOE low-level waste management forum: Technical session 6, Waste treatment.** (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013149/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This document contains eight reports describing current waste treatment strategies. Topics include regulations, technology assessment, soil contamination, volume reduction, solidification of liquid waste, and waste segregation programs. (TEM)

44764 (CONF-871075—Vol.1-Pt.3, pp 37-76) **In situ grouting of buried transuranic waste.** Spalding, B.P.; Lee, S.Y. (Oak Ridge National Lab., TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

This task is a demonstration and evaluation of the in situ hydrologic stabilization of buried transuranic waste at a humid site via grout injection. Two small trenches, containing buried transuranic waste, were filled with 34,000 liters of polyacrylamide grout. Initial field results have indicated that voids within the trenches were totally filled by the grout and that the intratrench hydraulic conductivity was reduced to below field-measurable values. The grout was also completely contained within the two trenches as no grout constituents were observed in the 12 perimeter ground water monitoring wells. Polyacrylamide grout was selected for field demonstration over polyacrylate grout because of its superior performance in laboratory degradation studies. Also supporting the selection of polyacrylamide was the difficulty of controlling the set time of the acrylate polymerization process in the presence of potassium ferricyanide. Based on preliminary degradation monitoring, polyacrylamide was estimated to have a microbiological half-life of 115 years in the test soil. However, this calculated value is likely to be conservatively low because microbial degradation of the grout set accelerator or residual monomer may be contributing most to the measured microbial respiration. Addition work, using ^{14}C-labeled acrylate and acrylamide grouts, is being carried out to more accurately estimate the grouts' microbiological half-life.

44765 (CONF-871075—Vol.1-Pt.3, pp 77-87) **Waste Examination Assay Facility operations TRU waste certification.** Schultz, F.J.; Caylor, B.A.; Coffey, D.E.; Phoenix, L.B. (Oak Ridge National Lab., TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The ORNL Waste Examination Assay Facility (WEAF) was established in a cooperative program with the Los Alamos National Laboratory (LANL) in April, 1982 to nondestructively assay (NDA) transuranic (TRU) waste generated at ORNL. The present facility charter encompasses the NDA and nondestructive examination (NDE) of both TRU and low-level wastes (LLW). Presently, the WEAF's NDA/NDE equipment includes a Neutron Assay System (NAS), a Segmented Gamma Scanner (SGS), a drum-sized Real-Time Radiography (RTR) system, and a Neutron Slab Detector (NSD). The first three instruments are computer interfaced. To date approximately 2300 TRU waste drums have been assayed with the NAS and SGS. Approximately 2500 TRU and LLW drums have been examined with the RTR unit. Computer data bases have been developed to collate the large amount of data generated during the assays and examinations. Additional NDA and NDE instruments will be added to the WEAF in the near future; a crate-sized RTR unit and an external gamma and neutron dose rate scan-

ner. The WEAF is being expanded (1600 sq. ft.) to accommodate the new instruments additional office space, and drum storage.

44766 (CONF-871075—Vol.1-Pt.3, pp 215-234) **Waste minimization program at the feed materials production center.** Blasdel, J.E.; Crotzer, M.E.; Gardner, R.L.; Kato, T.R.; Spradlin, C.N. (Westinghouse Materials Co. of Ohio, Cincinnati (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-86OR21600.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

A waste minimization program is being implemented at the Feed Materials Production Center to reduce the generation of uranium-contaminated wastes and to comply with existing and forthcoming regulations. Procedures and plans are described which deal with the following wastes: process and non-process trash, contaminated wood and metals, used metal drums, and major process wastes such as contaminated magnesium fluoride and neutralized raffinate. Waste minimization techniques used include segregation, source reduction, volume reduction, material substitution and waste/product recycle. The importance of training, communication, and incentives is also covered.

44767 (CONF-871075—Vol.1-Pt.3, pp 279-289) **Processing of stored uranium tetrafluoride for productive use.** Whinnery, W.N. III. (Paducah Gaseous Diffusion Plant, KY (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

Waste uranium tetrafluoride (UF4) was created from converting uranium hexafluoride (UF6) to UF4 for generation of hydrogen fluoride. This resulted in more tails cylinders being made available in the early days of the Paducah Gaseous Diffusion Plant. A need arose for the UF4; however, a large portion of the material was stored outside in 55-gallon drums where the material became caked and very hard. Chemical operations crushed, ground, and screened a large portion of the waste UF4 from 1981-1987. Over 111,935,000 pounds of the material has been processed and put into productive use at Westinghouse Materials Company of Ohio or at Department of Defense facilities. This long-term effort saved the disposal cost of the material which is estimated at $9,327,900. In addition, the work was for an outside contract which lowered the operating cost of the Chemical Operations Department by $4,477,400. Disposal options for the material still present in the current inventory are outlined.

44768 (CONF-871075—Vol.1-Pt.3, pp 303-311) **Evaluation of proposed shallow-land burial sites using the PRESTO-II methodology and code.** Fields, D.E.; Uslu, I.; Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

PRESTO-II (Prediction of Radiation Effects from Shallow Trench Operations) is a computer code designed to evaluate possible doses and risks from shallow-land burial sites. The model is intended to serve as a non-site-specific screening model for assessing radionuclide transport, ensuing exposure, and health impacts to a static local population for a 1000-year period following the end of disposal operations. Human exposure scenarios include normal releases human intrusion, and limited site farming or reclamation. Pathways and processes of transport from the trench to an individual or population include ground-water transport, overland flow, erosion, surface water dilution, suspension, atmospheric transport and deposition, inhalation, external exposure, and ingestion of contaminated beef, milk, crops, and water. The proposed waste disposal area in Koteyli, Balikesir, Turkey, has been evaluated using the PRESTO-II methodology. The results have been compared to those obtained for the Barnwell, South Carolina, site. Dose estimates for both sites are below regulatory limits, for the release and exposure scenarios considered. The doses for the sites are comparable, with slightly higher estimates obtained from the Turkish site.

44769 (CONF-871075—Vol.1-Pt.3, pp 409-423) **Oak Ridge Greater Confinement Disposal demonstrations.** Van Hoesen, S.D.; Clapp, R.B. (Oak Ridge National Lab., TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

A number of Low-Level Waste (LLW) disposal demonstrations are being conducted by the Low-Level Waste Disposal Development and Demonstration Program (LLWDDD) for the Department of Energy (DOE). This paper will focus on Greater Confinement Disposal (GCD) demonstrations being conducted in association with the disposal of a high activity low-level waste (LLW) stream to be produced by Oak Ridge National Laboratory (ORNL).

44770 **(CONF-8804134—3) Experimental hydration studies of natural and synthetic glasses.** Bates, J.K.; Abrajano, T.A. Jr.; Ebert, W.L.; Mazer, J.J.; Gerding, T.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011986/JAW.

From Symposium on materials stability and environmental degradation; Reno, NV, USA (5 Apr 1988).

The results of a series of hydration experiments on natural glasses (Hawaiian basalt, obsidian) and the nuclear waste glass WV-44 done to examine laboratory methods of accelerating reaction processes are summarized. The glasses were reacted in hydrothermal solution and in saturated vapor water. It was found that different reaction rates and processes were found using the differing conditions, and that laboratory efforts to accelerate and duplicate natural processes must amount for the physical processes that occur naturally. 18 refs., 5 figs., 1 tab.

44771 **(CORR—870116) Ecologic assessment of closure options for Savannah River Plant waste sites: Task 38, AX-681812.** (Science Applications, Inc., Oak Ridge, TN (USA)). 17 Apr 1987. 446p. (SAIC—87/1645). NTIS, PC A19. Order Number DE88013208/JAW.

Ecologic assessment of closure options is one of several analyses being documented in the EIDs (along with analysis of relative potential health risks, accident risks, and costs). This information will serve as a basis for choosing the best option for closing a particular waste facility. This report presents the methodology adopted for SRP waste site ecological assessment, and the results of its application. The results of the ecologic assessment indicated that no impacts are expected for any of the closure options at eleven sites. Significant ecologic impacts are possible at the eight waste sites or groups of waste sites including the Radioactive Waste Burial Grounds, Old TNX Seepage Basin, CMP Pits, F-Area Seepage Basins, H-Area Seepage Basins, SRL Seepage Basins, R-Reactor Seepage Basins, and L-Area Oil and Chemical Basin. 104 refs., 22 figs., 241 tabs.

44772 **(DOE/CH/46656—14(2)) Site characterization plan conceptual design report for a high-level nuclear waste repository in salt, horizontal emplacement mode: Volume 2.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA)). Dec 1987. Contract AC02-87CH10290;AC02-83WM46656. 522p. (BMI/ONWI/C—127). H. Order Number DE88012838/JAW.

Chapter 6 discusses the repository design features and operating procedures that will be used to ensure compliance with regulatory limits for preclosure releases, performance objectives for waste retrieval, and performance objectives for post closure or long-term waste isolation. Chapter 7 discusses the analyses that were conducted in developing the repository design and the impacts of various external factors on the design of repository elements and the repository as a whole. These discussions are divided into preclosure design analysis, post closure design analysis, and engineering analysis of design. Also discussed are the structures, systems, and components that have been identified as important to safety and the barriers that have been, or need to be, identified as important to waste isolation. Chapter 8 discusses the engineering

design information needs that were identified during conceptual design as necessary to advance the current conceptual design to Licence Application Design. These information needs should be resolved during the site characterization program or by other technology development studies. The discussion of these design issues and data needs is arranged according to the major elements of the repository. Chapter describes the quality assurance program. 146 refs., 40 figs., 22 tabs.

44773 (DOE/HWP—52) Improved treatment/disposal of reactive metals: Phase 1, Detailed project planning and concept development report. Rajan, J.B.; Helt, J.E.; Borys, S.S. (Argonne National Lab., IL (USA)). 12 Jan 1988. Contract W-31109-ENG-38;AC05-84OR21400. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012756/JAW.

This document was prepared for an effort to develop improved methods for the treatment/disposal of reactive metals. The work is being performed by Argonne National Laboratory for the US DOE Hazardous Waste Remedial Actions Program. The document represents the final report for Phase 1, Detailed Project Planning and Concept Development. It includes a detailed plan for all five phases of the project, specifically addressing the DOE-Defense Programs need, funding, selection criteria, schedule, quality assurance, etc. for each phase of the project. 11 refs., 12 figs., 4 tabs.

44774 (DOE/ID/12576—T18) Projections of waste characteristics for the Midwest Compact Region, 1985-2015: Regional Management Plan: Final report on Task 3, Deliverable 3A. Frato, K.A.; Meckstroth, K.W. (Midwest Interstate Low-Level Radioactive Waste Commission, St. Paul, MN (USA); ERM-Midwest, Inc., Columbus, OH (USA)). 11 Jul 1986. Contract FG07-85ID12576. 76p. NTIS, PC A05;3. Order Number DE88012164/JAW.

A critical step in determining future low-level waste facility needs in the region is development of region-wide waste projections. This report provides projections of low-level radioactive waste for a 30-year period, extending to the year 2015; the work is the result of Task 3 of an overall 6-task Management Plan development process. The base year for these projections is 1985, and is an estimate based on the best available data on current generation obtained in Task 2. 14 refs., 3 figs., 9 tabs.

44775 (DOE-RW—87.009) Bituminous and asphaltic membranes for radioactive waste repositories and land. Final report. (Department of the Environment, London (UK); MRM Partnership, Bristol (UK)). Mar 1988. 235p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88753842/JAW.

The aim of the study has been to identify, within generic designs for waste facilities, areas where bituminous materials might be incorporated as a barrier. The report is presented in three sections: Part I - The properties of bitumen are described, with particular reference to the long-term behaviour of the material. The durability of bitumen is discussed, including aspects such as ageing, microbial degradation, chemical resistance and radiation resistance. Part II - The use of bituminous materials in hydraulic engineering is outlined. Much of this section of the report concentrates on the use of bituminous materials in embankment dams and reservoir construction. A review of material technology and construction techniques is presented and a detailed assessment made of the performance of the materials in service. Part III - Generic trench type radioactive waste repository designs incorporating bituminous materials are presented. Material and construction specifications for the designs are detailed, and a performance assessment presented.

44776 (DOE-RW—88.052) Study on the water permeability of concrete structures. Loadsman, R.V.C.; Acres, D.H.; Stokes, C.J.; Wadeson, L. (Binnie and Partners, London (UK)). (Department of the Environment, London (UK)). Mar 1988. 244p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88754530/JAW.

This report forms part of the DoE's research programme on the disposal of nuclear waste. The information available on the permeability of concrete and the effects of various factors on this value are reviewed. The effect of defects on the overall permeability of concrete structures is examined and the recorded performance of a range of existing concrete structures is considered with identification of some of the factors that are significant in practice. Deficiencies in the information available on this subject are identified and recommendations for further work are made including a list of structures suitable for future monitoring.

44777 (DOE/RW—0191) Office of Civilian Radioactive Waste Management: Annual capacity report. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Jun 1988. 91p. H. Order Number TI88012948/JAW.

The system configuration used as the basis for this year's report is the authorized system defined in the Mission Plan Amendment. It includes a Monitored Retrievable Storage (MRS) facility as an integral system component. The illustrative waste acceptance schedule for this WMS configuration reflects the amended first repository schedule and a proposed schedule for the MRS facility. This schedule provides only an approximation of when and how the system may operate and is subject to changes as recognized in the draft Mission Plan Amendment. During the first 10 years of WMS operation, the total quantity of spent fuel that could be accepted is projected to be 24,100 metric tons uranium (MTU). The allocation of acceptance rights is currently based on the projected annual capacity of the WMS to receive SNF and the age of permanently discharged spent fuel as determined from 1986 data provided by the Purchasers of waste disposal services on the 1987 Nuclear Fuel Data Form, RW-859. The allocations are based on assigning the highest priority to the oldest fuel on an industry-wide basis. The Annual Capacity Report (ACR) provides a discussion of the requirement for the ACR and the role it plays in DOE's interaction with the Purchasers in implementing the provisions of the Standard Disposal Contract. The currently projected annual acceptance capacity to be allocated and a discussion of some of the impacts the Nuclear Waste Policy Amendments Act of 1987 may have on the Purchasers, DOE, and the Contract are presented. The basis and procedure for allocating this capacity (acceptance rights) are discussed. The status of the ACR Issue Resolution Process and DOE responses to comments on the 1987 ACR are discussed. 7 refs.

44778 (DOE/WIPP—87-017-Vol.2) Waste Isolation Pilot Plant: Geotechnical field data and analysis report, July 1986-June 1987: Volume 2. (Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept.). Mar 1988. Contract AC04-86AL31950. 511p. NTIS, PC A22. Order Number DE88013971/JAW.

The Geotechnical Field Data and Analysis Report (GFDAR) is prepared to provide a timely assessment of the geotechnical status of the Waste Isolation Pilot Plant (WIPP). During the period of shaft sinking and construction of the principal underground access and experimental areas, reporting was on a quarterly basis. Because geotechnical responses of existing underground facilities have slowed to nearly steady-state and excavation of the waste storage panels will take place more slowly and over an extended period, reporting in the coming years will be on an annual cycle. Volume 2 constitutes the principal documentation and presentation of data and techniques used to acquire the data, the performance history of the instrumentation, and the complete set of data from each of the underground facilities. In addition, it presents the results of geologic logging, stratigraphic mapping, and mapping and evaluation of excavation-induced fractures. This volume has as its anticipated audience those Project personnel who need to perform data analyses beyond those provided in Volume 1, and external personnel who may choose to perform other analyses and evaluations for their own purposes. 2 refs., 368 figs., 27 tabs.

44779 (DOE/WIPP—88-004) Facies variability and post-depositional alteration within the rustler formation in the vicinity of the waste isolation pilot plant, southeastern New Mexico. Holt, R.M.; Powers, D.W. (Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept.). Jan 1988. Contract AC04-86AL31950. 432p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE88013969/JAW.

The purpose of this study is to describe the detailed sedimentology, interpret the depositional environments of the Rustler, and to reassess the extent of Rustler dissolution. The reconstructed

depositional environments help to bound the extent and relative timing of dissolution. Existing literature was surveyed to distill criteria by which dissolution can be recognized. Microscopic examination of diagenetic alteration of the Rustler rounds out the evidence. The Rustler was examined in detail in two shafts and many cores from the vicinity of the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico. Nearly 600 geophysical logs from boreholes in southeastern New Mexico were interpreted, and the stratigraphy and lithology over a larger study area were related to units observed in cores and shafts from the WIPP site. 103 refs., 79 figs., 1 tab.

44780 (ENEA-RT-COMB—87-8) **Characterization and control of solidified radioactive wastes according to Italian regulations. Organization of a characterization facility and first results.** (ENEA, Rome (Italy)). Sep 1987. 23 p. (CONF-870511—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754246/JAW.

From 4. international hazardous waste symposium on environmental aspects of stabilization-solidification of hazardous and radioactive wastes; Atlanta, GA, USA (3 May 1987).

According to the Technica Guide N. 26 officially released this year by the Italian Regulatory Body (ENEA-DISP), radioactive wastes are now classified in Italy in accordance with the identities and the concentrations of radionuclides, no distinction being made from the point of view of physical states. Three radwaste categories have been established. The third one mainly refers to the high activity liquids arising from the first cycle of the fuel reprocessing facilities and to the alpha bearing wastes. The second category radwaste, which is the most important one in terms of overall production, refers to those wastes whose radioactivity decay to radioactive levels is comparable with the exemption limits set up for natural radioactive solids, as a maximum, within a few centuries. The radwastes falling into this second category, which are those radwastes generated mainly by nuclear power plants, must be solidified by means of suitable solidification agents, such as cement, bitumen or polymers. Moreover, a test program must be performed to assure the compliance of the waste forms with a set of specified waste form characteristics. The tests to be applied for the control of characteristics of real radioactive solidified wastes are briefly described. They require, in some cases, the use of non-commercial apparatus to be operated in radiation controlled areas. A glove-box chain, also suitable for the characterization of solidified alpha wastes, has been designed and built. The first characterization test campaign has been carried out on BWR plant produced radwastes solidified in cement. The results obtained are presented.

44781 (ENEA-RT-COMB—87-12) **The decontamination of liquid HLW produced by EUREX pilot plant: Process selection study.** Pietrelli, L.; Grossi, G.; Torri, G.; Donato, A. (ENEA, Rome (Italy)). Dec 1987. 15 p. (CONF-860905—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754253/JAW.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

In fuel reprocessing plants, the selective separation of long-life radioactive fission products and transuranium actinides from aged, high-level liquid wastes, containing high amounts of aluminum nitrate and other salts, may greatly simplify their management, expecially in terms of overall production of active glass canisters. With reference to the chemical and radiochemical composition of these liquid wastes produced at the Italian pilot plant Eurex, some conceptual flowsheets, based on the separation of cesium, strontium and actinides by selective precipitation and/or ion exchange, both in acidic and alkaline media, are discussed. The recent laboratory scale results, using traced simulated solutions for the selective separation of cesium and strontium by means of sodium tetraphenylborate (NaTPB), phosphotungstic acid (PTA) and polyantimonic acid (PAA), are also presented.

44782 (ENEA-RT-PAS—87-13) **Characterization of products arising from the incorporation of low and medium level wastes in cement or polymer matrix.** De Angelis, G.; Caropreso, G. (ENEA, Rome (Italy)). Sep 1987. 25 p. (CONF-860909—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754243/JAW.

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

The incorporation of LLW and MLW in an inert matrix gives rise to products which have to be characterized in order to evaluate their behaviour under accident conditions during interim storage, transport and final disposal and to predict, as far as possible, the long term durability of solidified waste forms. Due to the lack of standard regulations, several tests are currently employed with the general aim of achieving a complete knowledge of the products under consideration. A general comprehension of the problems involved, however, can be achieved only by considering the system, solidified waste/drum/final repository, as a whole, and by taking possible interactions into account. The present work is a presentation of the most important characterization methods, and includes an indication of the regulations followed. A brief review of the principal waste streams, is also given with notes concerning the problems which their incorporation posed.

44783 (EPRI/EA/EL—5612, pp 4.11-4.14) **Testing of TSCA incinerator for destruction of PCBs in uranium-contaminated wastes.** Anderson, R.W. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—). Contract AC05-84OR21400.

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A Toxic Substances Control Act (TSCA) incinerator for environmentally safe destruction of PCBs and hazardous organic materials contaminated with low-level radioactive wastes from seven DOE facilities has been constructed at the Oak Ridge Gaseous Diffusion Plant, and has undergone performance testing with PCB surrogates. The system incorporates state-of-the-art off-gas treatment, a highly instrumented kiln and secondary combustion chamber, and an inert-atmosphere solids-handling feed system. Release of organic during an upset event, which triggers opening of the secondary combustion-chamber relief vent, will be prevented by maintaining excess oxygen in the kiln and a high temperature in the secondary combustion chamber with an operating burner. Mixtures of chlorinated benzenes used in performance testing to simulate destruction of PCB, worst-case studies to satisfy regulatory concerns, and implications of performance test results are discussed. 4 references.

44784 (IAEA-TECDOC—440, pp 229-243) **Low activation elements for fusion reactor materials.** Ponti, C. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

This study is aimed at determining the acceptability of each natural element as a constituent for fusion reactor materials, for the purpose of limiting the long-lived radioactivity, so that the material could be recycled, or disposed of by near-surface burial. The availability of a new and complete activation cross section library, REAC-ECN, allows to perform activation calculations for all the stable elements. The results show that there is little incentive in developing elementally tailored steels for the purpose of recycling. More interesting and feasible is the development of a steel with an optimized composition that would allow to reach SLB (Shallow Land Burial) conditions also for the first wall. A better knowledge is still needed in some fields: the level of a few critical impurities in raw materials and in the steels produced with them, the acceptable concentration of long-lived nuclei in SLB, and the accuracy of the cross sections for some important activation reactions. (author). 14 refs, 4 tabs.

44785 (IAEA-TECDOC—440, pp 245-256) **Fusion reactor wastes: Technical and radiological aspects for the management of wastes from NET and a commercial reactor.** Guetat, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Fusion waste studies have been pursued since 1983 in the framework of the European fusion technology programme. Both the NET IIIA design and a hypothetical commercial fusion reactor extrapolated from NET IIIA have been considered. Wastes are described and classified and comparisons made with the different wastes of PWRs. Regulations, recommendations, safety objectives for workers, transport and long-term reuse have been taken into account. Studies of NET steel (AISI 316 with normal levels of impurity) demonstrate that after one minute's operation, highly active waste will be produced requiring special handling precautions and that after five days operation, wastes produced by the first wall will have to be considered as HLW as far as long term safety is concerned, unless steel impurities are somehow reduced. Two kinds of questions can at present be asked about fusion reactor wastes: As far as the NET reactor is concerned: how can wastes be handled in the plant? are special equipment and handling procedures required inside the plant before evacuation of waste? will constraints be due to /sup 3/H or activation products? will HLW problems be solved in the period between the construction of NET and the first commercial Tokamak reactor? Only some of the information required to answer the above questions is currently available. Detritiation is currently being investigated and some experimental results on melting treatments are presented. This last treatment is useful for other applications in this field and has more and more chance of being adopted. A series of different treatments and operations is described. Two solutions already exist, based on current technological competence, for long term wastes: geological disposal (similar to that already used for PWRs) and sea dumping after storage (very interesting for HLW fusion wastes). (Abstract Truncated)

44786 (IAEA-TECDOC—440, pp 271-279) **Geological disposal of fusion wastes.** Broden, K.; Bergstroem, U.; Hultgren, A.; Olsson, G. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The concepts developed in Sweden for the management of radioactive wastes from fission power also form a natural basis for an approach to the management of fusion wastes. Against this background, work on the management of fusion wastes in the Swedish fusion research programme as associated to the European Fusion Technology Programme was started by STUDSVIK in 1983. A tentative strategy for the application of various disposal routes was worked out. In coordination with efforts by other parties it was decided to focus the Swedish work on shallow and deep geological disposal of fusion wastes with the assessment of safety and costs for these disposal routes as the primary objective. For the safety assessment, data published on the sorption and migration in the geosphere of some nuclides of interest were found to be scarce or missing. Sorption experiments have thus been performed to determine distribution coefficients for molybdenum, lead and inorganic carbon in sorption on rocks from artificial groundwater and from water equilibrated with concrete. The computer code BIOPATH has been used for the calculation of the turnover of nuclides in the biosphere and the resulting doses to man. Results from the sorption experiments and from a preliminary safety assessment are presented in the paper. The classification and characterization of waste from the operation of the Tokamak reactors NET IIIA and FCTR have been used together with specific disposal costs for the various wastes in the Swedish nuclear programme to estimate disposal costs for fusion wastes. Preliminary results of these estimates are given. (author). 15 refs, 2 figs, 6 tabs.

44787 **(INIS-mf—11240) Management of low- and intermediate-activity level radioactive wastes: current status and trends.** Pavlov, V.; Danchev, S.; Petkova, S.; Groshkov, G.; Sanchev, U. (Energoproekt, Sofia (Bulgaria)). 1986. 13p. (In Bulgarian). (CONF-8609439—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703262/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

A survey is given of the currently used method and installations for radioactive waste treatment and storage. Emphasis is placed on the low- and intermediate-activity level wastes, which are typical for WWER type reactors. A technique for bituminization of the radioactive wastes, developed at Energoproject to overcome the flaws of the existing methods, is reported.

44788 **(INIS-mf—11739) Selection of a backfilling method for roadway storage of POLLUX spent fuel casks.** Wildt, K.H. (Deutsche Gesellschaft zum Bau und Betrieb von Endlagern fuer Abfallstoffe m.b.H., Peine (Germany, F.R.)). Oct 1987. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754318/JAW.

For the backfilling of cavities in the roadways of an abandoned shaft for ultimate disposal of POLLUX spent fuel casks, the two methods suitable for this purpose are pneumatic backfilling, or slinger stowing. The two methods are described in detail by means of practical examples. The packing of spent fuel casks in a repository is explained, and the selection of the wasteform - specific, suitable backfilling method is reported. The backfilling methods are evaluated by means of a matrix considering as factors safety, technical feasibility, and economics. The results of the study indicate the slinger method to be best for the backfilling of disposal roadways for POLLUX casks.

44789 **(IOS-Rep—252) Suspended particulate studies over the Madeira Abyssal Plain.** Simpson, W.R. (Department of the Environment, London (UK); Institute of Oceanographic Sciences, Godalming (UK). Deacon Lab.). 1987. 86p. (DOE-RW—88.026). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753844/JAW.

Various aspects relating to suspended matter over the Madeira Abyssal Plain are discussed. Special attention is paid to the nepheloid layer including resuspension and transport processes; time variabilities in particle concentrations and fluxes; particle morphology, microbiology and chemical composition; phase association of metals. Also, tentative predictions of the behaviour of some radionuclides are made based on theory and data on rare earth elements. Instrumentation developed for the project is detailed - the deep water particle sampler.

44790 **(Juel—2170) Investigation of the entrainment of fission products during the vitrification of high-active waste. A basic conception of the off-gas treatment.** Vetter, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung; Technische Hochschule Aachen (Germany, F.R.)). Dec 1987. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754344/JAW.

During vitrification fission products and a sodium borat glass will be melted into one another at round about 1400 K. At this temperature the vapour pressure of some species is considerable and volatilization of some compounds might appear. In the present study the volatilization of fission products from the glass melt is analysed. The qualitative and quantitative entrainment is determined both by mass-spectrometry and by TG/DTA-investigations. The results of the small scale laboratory experiments are compared with measurements from vitrification plants. Based on these findings proposals are developed for the managing of the vitrification process and criterias are listed for the conception of the off-gas treatment.

44791 (Juel-Conf—61, pp 109-134) **Waste management for HTR.** Roellig, K.; Born, H.P.; Ragoss, H.; Storch, S. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.); Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.); Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The waste management concept set up for the AVR reactor and the THTR and their planned successors states direct ultimate disposal to spent fuel elements to be the only method envisaged. This is in compliance with the Federal German Atomic Energy Act, as the state of the art in fuel reprocessing today does not offer

a method of spent HTR fuel element reprocessing that would be technically feasible, or economically reasonable. The properties of spent HTR fuel elements allow simple waste forms to be packed, with the container (a 400 litre waste drum) mainly offering good handling. The waste packages are up to the current requirements for after-heat developing waste destined for ultimate disposal at a waste site prepared by the borehole technique. The results of research into disposal methods for after-heat developing MAW from LWR fuel reprocessing can be applied to the ultimate disposal of HTR spent fuel, and this offers economic advantages. Further advantages can be drawn from a suitable, ultimate disposal oriented fuel element design, and interim storage site design. For current and planned HTR plant, different interim storage concepts are set up, but for ultimate disposal, the 400 litre waste drum is the only waste form for all waste type. Proof of suitability of AVR and THTR fuel elements for ultimate disposal thus is a decisive task with regard to ultimate disposal of the spent fuel of successor plant.

44792 (Juel-Conf—61, pp 147-160) **R and D activities for ultimate disposal of HTR spent fuel elements.** Ganser, B.; Brinkmann, U.; Brodda, B.G.; Duwe, R.; Roellig, K. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.); Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

For the direct ultimate disposal of HTR spent fuel, the LWR MAW storage method is examined, with a view to the following aspects: Activity released under rock pressure, and data of the design basis accidents: drop of waste package, underground fire, and inflow of lye in the post-operational phase of the repository. Strength tests with model packages containing HTR spent fuel in loose packing, or backfilled, have shown that backfilling with cement mortar or sand prevents damage to the spent fuel caused by rock pressure. Particle cracking in damaged, not backfilled fuel elements was at a maximum of 1 p.c. In leaching experiments with spent, complete fuel elements (90/sup 0/C - 200/sup 0/C and 130/300 bar) only contaminations of the graphite matrix were released. Nuclide release after some 100 days of leaching time is determined by diffusion processes, but even after 1250 days of leaching, only trace amounts of Cs, Sr, Ce, Ba, Eu, Co, actinides or heavy metals could be found. High burn-up UO/sub 2/ fuel kernels without coating and graphite matrix under the effects of leaching at 90/sup 0/C, 130 bar already after 60 days exhibited strong corrosion damage, and after about 100 days, cesium was released almost completely.

44793 (Juel-Conf—61, pp 161-177) **Ultimate disposal of HTR spent fuel elements in a borehole-prepared site.** Barnert, E.; Brinkmann, U.; Bruecher, H.; Kroth, K.; Niephaus, D. Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The concept of the Federal Republic of Germany for disposal of radioactive waste that considerably develops heat is to place them in vertical boreholes in salt rock. Among the wastes to be placed there is MAW from the LWR spent fuel reprocessing, and spent fuel from HTR. The technical know-how required for this method is acquired within the project 'MAW and HTR spent fuel test storage in boreholes', under KFA project leadership. Goals and organisation of the project are explained, and the status of work performed with particular regard to HTR spent fuel management is reported.

44794 (KFK—4361) **Powder technological vitrification of simulated high-level waste.** Gahlert, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Technische Hochschule Aachen (Germany, F.R.)). Mar 1988. 212p. (In German). (PWA—87/87). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88754349/JAW.

High-level waste simulate from the reprocessing of light water reactor and fast breeder fuel was vitrified by powder technology. After denitration with formaldehyde, the simulated HLW is mixed with glass frit and simultaneously dried in an oil-heated mixer. After 'in-can calcination' for at least 24 hours at 850 or 950 K (depending on the type of waste and glass), the mixture is hot-pressed in-can for several hours at 920 or 1020 K respectively, at pressures between 0.4 and 1.0 MPa. The technology has been demonstrated inactively up to diameters of 30 cm. Leach resistance is significantly enhanced when compared to common borosilicate glasses by the utilization of glasses with higher silicon and aluminium content and lower sodium content.

44795 (LA-UR—88-1675) **Combining qualitative and quantitative data: The use of subjective judgment modeling.** Booker, J.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 23p. (CONF-880872—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number TI88010948/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

In risk assessments of high level waste disposal problems, the paucity or absence of data makes it necessary to rely on expert opinion information. This information is usually in the form of a mixture of qualitative and quantitative information (data). Regardless of which methods are used to handle this mixture, certain issues such as granularity and conditionality cannot be ignored. These issues are discussed as they impact some of the major methods in current use. Examples of how to handle this data mixture are provided for some of the classical methods and for some of the newer, cognitive and data-based methods. 13 refs., 5 figs.

44796 (LBL—23986) **Steady-state radionuclide transfer from a cylinder intersected by a fissure.** Zavoshy, S.J.; Chambre, P.L.; Ahn, J.; Pigford, T.H.; Lee, W.W.L. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 33p. (UCB-NE—4113). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014060/JAW.

The steady-state concentration of a diffusing nuclide from a waste cylinder has been obtained from the exact analytical solution. Two phenomena which have been neglected by the previous investigators include the effect of axial diffusion in the fissure, and the effect of radial diffusion in the porous rock. Our numerical results indicate that, for a waste-cylinder radius of 15 cm and fissure width of 2 cm, one can neglect diffusion in the axial direction in the fissure, i.e., assume a uniform concentration in the axial direction. The steady-state concentration at the fissure/rock interface is ≧99.9 percent of the concentration at the fissure's center line. Hence, one can use a simplification, i.e., that the concentration of the nuclide in the fissure in the transverse direction (z direction) is uniform. On the other hand, radial diffusion in the porous rock is very important and should not be neglected. At steady-state about 3 times more mass is lost from the waste cylinder to the rock than is lost to the fissure. Furthermore, results indicate that close to the waste cylinder approximately 100 times more mass is transported in the radial direction in the porous rock adjacent to the fissure than is diffused across the fissure/rock interface. Therefore, neglect of radial diffusion in the porous rock will cause underestimation of the dissolution rate. 11 refs., 8 figs., 1 tab.

44797 (LBL—25296) **Thermodynamic data management system for nuclear waste disposal performance assessment.** Phillips, S.L.; Hale, F.V.; Siegel, M.D. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 29p. (CONF-870594—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013596/JAW.

From International conference on thermodynamics of aqueous systems with industrial applications; Warrenton, VA, USA (10 May 1987).

Thermodynamic property values for use in assessing the performance of a nuclear waste repository are described. More emphasis is on a computerized data base management system which facilitates use of the thermodynamic data in sensitivity analysis and other studies which critically assess the performance of disposal sites. Examples are given of critical evaluation procedures; comparison of apparent equilibrium constants calculated from the data base, with

other work; and of correlations useful in estimating missing values of both free energy and enthalpy of formation for aqueous species. 49 refs., 11 figs., 6 tabs.

44798 (MLM—3507(OP)) Tritium Emissions Reduction Facility. Wieneke, R.E.; Bowser, R.P.; Hedley, W.H.; Kissner, T.J.; Lamberger, P.H.; Morgan, F.G.; Van Patten, J.F.; Williams, M.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1988. Contract AC04-76DP00053. 5p. (CONF-880505—32). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012880/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The Tritium Emissions Reduction Facility (TERF) will be a system for the continuous processing of tritium containing gases collected from various operations at Mound. The basis of the system operation will be the oxidation of elemental hydrogen isotopes and organic molecules at elevated temperatures on precious metal catalyst beds, and the adsorption of the resulting oxide (water) on molecular sieve dryers. The TERF will be expected to handle from 400,000 to 1,000,000 curies of tritium per year in the process gas stream and release no more than 200 curies per year to the atmosphere. Consequently, the TERF will need to convert and capture tritium at low concentrations in gas efficiently and reliably. 5 refs., 2 figs.

44799 (NSS/G—104) Gas evolution and migration in repositories: current status. Rees, J.H.; Rodwell, W.R. (UKAEA Harwell Lab. Chemistry Div.; UKAEA Atomic Energy Establishment, Winfrith). (United Kingdom Nirex, Ltd.). Apr 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754531/JAW.

Considerable volumes of gas may be formed in a repository due to corrosion of metallic wastes and microbial degradation of certain organic wastes. The requirements for data and models to help understand the rate of formation of gases and their migration are described. The Nirex research programme in the area complements existing knowledge and takes additional priorities from the outcome of site assessments. Key areas currently being studied include: the rate of evolution of hydrogen from steel under anaerobic conditions; and of carbon dioxide and methane from cellulosic materials; characterisation of near- and far-field materials with respect to gas transport (permeabilities, capillary pressures, etc); and development of a comprehensive series of models covering gas evolution and migration in the near and far fields.

44800 (NUREG—1308-Rev.1) Radioactive material in the West Lake Landfill: Summary report. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Industrial and Medical Nuclear Safety). Jun 1988. 16p. NTIS, PC A03/MF A01 - GPO. Order Number TI88012946/JAW.

The West Lake Landfill is located near the city of St. Louis in Bridgeton, St. Louis County, Missouri. The site has been used since 1962 for disposing of municipal refuse, industrial solid and liquid wastes, and construction demolition debris. This report summarizes the circumstances of the radioactive material in the West Lake Landfill. The radioactive material resulted from the processing of uranium ores and the subsequent by the AEC of processing residues. Primary emphasis is on the radiological environmental aspects as they relate to potential disposition of the material. It is concluded that remedial action is called for. 8 refs., 2 figs., 1 tab.

44801 (ORNL/TM—10573) Soils, surficial geology, and geomorphology of the Bear Creek Valley Low-Level Waste Disposal Development and Demonstration Program site. Lietzke, D.A.; Lee, S.Y.; Lambert, R.E. (Oak Ridge National Lab., TN (USA)). Apr 1988. Contract AC05-84OR21400. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88013501/JAW.

An intensive soil survey was conducted on the proposed Low-Level Waste Disposal Development and Demonstration Program site (LLWDDD) in Bear Creek Valley. Soils on the site were related to the underlying residuum and to the surficial colluvium and alluvium. Within any particular geologic formation, soils were subdivided based mostly on the degree of weathering, as reflected by saprolite weathering and morphologic features of the soils. Degree of weathering was related both to slope shape and gradient and to the joint-fracture system. Erosion classes were also used to make further subdivisions of any particular soil. Deep pits were dug in each of the major Conasauga Group formations (Pumpkin Valley, Rogersville, Maryville, and Nolichucky) for soil and saprolite characterization. Because of the widespread presence of alluvium and colluvium, which are potential sources of fill and final cover material, pits and trenches were dug to characterize the properties of these soils and to try to understand the past geomorphic history of the site. The results of the soil survey investigation indicated that the deeply weathered Pumpkin Valley residuum has good potential for the construction of tumuli or other types of belowground or aboveground burial of prepackaged compacted waste. 11 refs., 30 figs., 3 tabs.

44802 (ORNL/TM—10696) A review and analysis of European industrial experience in handling LWR [light water reactor] spent fuel and vitrified high-level waste. Blomeke, J.O. (ed.). (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013505/JAW.

The industrial facilities that have been built or are under construction in France, the United Kingdom, Sweden, and West Germany to handle light-water reactor (LWR) spent fuel and canisters of vitrified high-level waste before ultimate disposal are described and illustrated with drawings and photographs. Published information on the operating performances of these facilities is also given. This information was assembled for consideration in planning and design of similar equipment and facilities needed for the Federal Waste Management System in the United States. 79 refs., 71 figs., 10 tabs.

44803 (ORNL/TM—10811) Transportation operations functions of the Federal Waste Management System. Shappert, L.B.; Attaway, C.R.; Best, R.E.; Jones, R.H.; Jowdy, A.K.; Kline, S.C.; Peterson, R.W.; Rawl, R.R. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013513/JAW.

This document discusses the functions that are required to accept the waste, transport the waste, and provide the mandatory support activities. These functions are independent of any organizational structure and reflect a conventional and generally accepted transportation system involving casks; ancillary equipment; truck, rail, and barge transporters; cask and vehicle maintenance facilities; traffic management activities; and other related support system subelements. Where appropriate, the functions are ordered to identify their relationship with each other. This relationship is depicted graphically in functional flow block diagrams (FFBDs). The FFBDs provide a definition of the functions that the systems must perform; a tool to aid in the identification of important issues and trade-off studies; an important method for tracing requirements and decisions back to essential functions; and a basis for allocating the functions, a process that will identify where, how, and by whom they will be performed. 22 refs., 13 figs.

44804 (ORNL/TM—10845) Guidance document for conducting waste management demonstration projects. Singh, S.P.N.; Genung, R.K.; Jolley, R.L. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013514/JAW.

This document presents the basic framework that has been developed for conducting waste management technology demonstration at the US Department of Energy/Oak Ridge Operations (DOE/ORO) sites. The guidance is based on experience gained by the Waste Management Technology Center (WMTC) in carrying out several innovative waste management technology demonstrations as part of its charter under the DOE/ORO's DOE Model program. The step-by-step procedure described in this report should be used for all future technology demonstrations on DOE/ORO-managed sites. This procedure is designed to ensure that the demonstrations are conducted in compliance with applicable federal, state, and local regulations, as well as with DOE/ORO Orders and Martin Marietta Energy Systems, Inc., policies and procedures.

44805 **(PNL—5649) A comparison of uncertainty analysis methods using a groundwater flow model.** Doctor, P.G.; Jacobson, E.A.; Buchanan, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013958/JAW.

This report evaluates three uncertainty analysis methods that are proposed for use in performances assessment activities within the OCRWM and Nuclear Regulatory Commission (NRC) communities. The three methods are Monte Carlo simulation with unconstrained sampling, Monte Carlo simulation with Latin Hypercube sampling, and first-order analysis. Monte Carlo simulation with unconstrained sampling is a generally accepted uncertainty analysis method, but it has the disadvantage of being costly and time consuming. Latin Hypercube sampling was proposed to make Monte Carlo simulation more efficient. However, although it was originally formulated for independent variables, which is a major drawback in performance assessment modeling, Latin Hypercube can be used to generate correlated samples. The first-order method is efficient to implement because it is based on the first-order Taylor series expansion; however, there is concern that it does not adequately describe the variability for complex models. These three uncertainty analysis methods were evaluated using a calibrated groundwater flow model of a unconfined aquifer in southern Arizona. The two simulation methods produced similar results, although the Latin Hypercube method tends to produce samples whose estimates of statistical parameters are closer to the desired parameters. The mean travel times for the first-order method does not agree with those of the simulations. In additions, the first-order method produces estimates of variance in travel times that are more variable than those produced by the simulation methods, resulting in nonconservative tolerance intervals. 13 refs., 33 figs.

44806 **(PNL—6205) Criticality experiments to provide benchmark data on neutron flux traps.** Bierman, S.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013957/JAW.

The experimental measurements covered by this report were designed to provide benchmark type data on water moderated LWR type fuel arrays containing neutron flux traps. The experiments were performed at the US Department of Energy Hanford Critical Mass Laboratory, operated by Pacific Northwest Laboratory. The experimental assemblies consisted of 2 {times} 2 arrays of 4.31 wt % ^{235}U enriched UO_2 fuel rods, uniformly arranged in water on a 1.891 cm square center-to-center spacing. Neutron flux traps were created between the fuel units using metal plates containing varying amounts of boron. Measurements were made to determine the effect that boron loading and distance between the fuel and flux trap had on the amount of fuel required for criticality. Also, measurements were made, using the pulse neutron source technique, to determine the effect of boron loading on the effective neutron multiplications constant. On two assemblies, reaction rate measurements were made using solid state track recorders to determine absolute fission rates in ^{235}U and ^{238}U. 14 refs., 12 figs., 7 tabs.

44807 **(PNL-SA—15161) A stable isotope method for reactor decommissioning waste classification: [Final report].** Evans, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1987. Contract AC06-76RL01830. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013116/JAW.

A stable isotope method is proposed for the determination of neutron fluence to highly irradiated components of reactor internals. Experimentally determined neutron fluences could be combined with suitable composition information in an activation code for calculation of long-lived radionuclide inventory and waste classification, as specified by 10 CFR 61. Suitable flux indicators are boron and tungsten. Lithium and selenium are also discussed as less desirable alternatives. The trace element of interest would be chemically separated from a small subsample of the steel component. The isotopic composition of the nonradioactive elemental fraction would be determined by induction coupled argon plasma/mass spectrometry (ICAP/MS). The method offers the advantage of providing reliable waste classification in compliance with the requirements of 10 CFR 61 without the need for offsite shipping of radioactive samples. The formidable problems associated with subsampling of large and highly radioactive reactor components would limit the method to use as a tool for activation-code validation rather than routine classification.

44808 **(PNL-SA—15941) Safety aspects of using cesium-137 in large irradiators.** Tingey, G.L.; Hazelton, R.F. (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 23p. (CONF-8805156—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012692/JAW.

From Nuclear Regulatory Commission irradiator workshop; Arlington, TX, USA (24 May 1988).

Although several gamma producing radioisotopes have been considered as irradiation sources, only cobalt-60 and cesium-137 have been used extensively. Cesium, a product from the fissioning of uranium-235 nuclear reactor fuel, remained with the high level waste (HLW) during spent fuel reprocessing at DOE's Hanford fuel reprocessing facilities. This cesium, containing about 50% gamma-producing cesium-137, was subsequently recovered from the HLW for waste management purposes, purified, and encapsulated as cesium chloride (CsCl) in heavy-walled stainless steel cylinders. These capsules were made available from DOE on a lease basis and 38 MCi of cesium is now being used as gamma sources in four commercial irradiators in the United States. This presentation examines the safety aspects of using cesium in large irradiators. Subjects covered include encapsulation of byproduct cesium, capsule design, testing to assure capsule integrity for both shipping and operation, and data from the destructive examination of capsules after use in irradiators for up to five years.

44809 **(RFP—4181) Variable matrix combustible crate design and fabrication.** Younger, A.F.; Thomas, R.L. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 25 Mar 1988. Contract AC04-76DP03533. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013613/JAW.

A Variable Matrix Combustibles Crate Standard was designed and built to calibrate and control the neutron assay crate counter for shipping waste crates containing plutonium-contaminated wet combustibles and plastics. The design was flexible to accommodate varied weights as well as varied hydrogen and chlorine contents. 1 ref., 8 figs., 1 tab.

44810 **(SKB-TR—87-13) Shallow reflection seismic investigation of fracture zones in the Finnsjoe area, method evaluation.** Dahl-Jensen, T.; Lindgren, J. (Uppsala Univ. (Sweden). Dept. of Geophysics). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Jun 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754366/JAW.

In the Finnsjoe area a reflection seismic profile has been shot. Under the profile the crystalline bedrock lies close to the surface (seldom more than 2 m), and the seismic velocities are high. There are known fracture zones in the area. A larger, sub horizontal fracture zone (zone 2) turned out to be difficult to detect, while a steeply dipping zone (Braendan zone) seems to be more reflective. It has not been possible to present a stacked section that enhances zone 2 so it can be followed along the profile. A reason can be that it simply is not a very reflective zone.

44811 **(SKB-TR—87-22) Radionuclide sorption on granitic drill core material.** Eriksen, T.E.; Locklund, B. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Nuclear Chemistry). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Royal Inst. of Tech., Stockholm (Sweden). Dept. of Nuclear Chemistry). Nov 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754370/JAW.

Distribution ratios were determined for Sr-85, Cs-134 and Eu-152 on crushed granite and fissure coating/filling material from Stripa mines. Measurements were also carried out on intact fissure surfaces. The experimental data for Sr-85, Cs-134 on crushed material can be accomodated by a sorption model based on the assump-

tion that the crushed material consists of porous spheres with outer and inner surfaces available for sorption. In the case of Eu-152 only sorption on the outer surfaces of the crushed material was observed. The absence of sorption on inner surfaces is most probably due to high depletion of the more strongly sorbed Eu-152 in the water phase and very low diffusivity of Eu-152 in the sorbed state.

44812 (SRD-R—450) Radioactive waste disposal by UKAEA establishments during 1985 and associated environmental monitoring results. Meggitt, G.C.; Phillips, F. (UKAEA Safety and Reliability Directorate, Culcheth). Sep 1987. 19p. H.M. Stationery Office, London, price Pound 4.00.

This report gives details of the amount and types of solid, liquid and gaseous wastes disposed of by establishments of the United Kingdom Atomic Energy Authority in 1985. The results obtained from surveys designed to monitor the impact of the gaseous and liquid discharges are summarised.

44813 (TULEA—1986-12) Rock displacements during the buffer mass test at Stripa. Leijon, B. (Luleaa Coll. and Inst. of Tech. (Sweden). Div. of Rock Mechanics). 1986. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754504/JAW.

As a part of the Buffer Mass Test, rock mechanics measurements were performed with the aim to assess the interaction between the highly compacted bentonite buffer material and the surrounding rock. The measurements included long term monitoring of vertical rock displacements in four holes drilled adjacent and parallel to heater hole No. 5. Displacements were expected to occur as a result of the thermal load applied to the rock, and of loadings exerted by the confined swelling of highly compacted bentonite. The ISETH Sliding Micrometer, a portable precision borehole extensometer, was used for the measurements. This manually operated instrument provides accurate determinations of the distance between measuring marks, preinstalled at 1 m intervals along the borehole. By repeatedly applying this technique throughout the operation time of the Buffer Mass Test, the time dependent distribution of displacement along continuous vertical profiles, extending from the tunnel floor and down to levels below the zone influenced by the test, was recorded. The results show a teporally and spatially uniform thermal expansion behaviour of the rock. The maximum vertical strain, occurring at the heater level, is about 50x10/sup -6/ and the resulting heave of the tunnel floor is of the order of 0.16mm. There is no indication of discontinuous rock deformation. Excluding the uppermost 1 m near the tunnel floor, it appears that the swelling pressure developing in the highly compacted bentonite and reaching a maximum value of about 5 MPa, did not cause any measurable vertical displacements.

44814 (UCID—21347) Plan for waste package design, fabrication and prototype testing for NNWSI [Nevada Nuclear Waste Storage Investigations]. Russell, E.W.; Nelson, T.A. (Lawrence Livermore National Lab., CA (USA)). Feb 1988. Contract W-7405-ENG-48. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012448/JAW.

The activities addressed in this Scientific Investigation Plan are directed toward planning and developing the design inputs that are necessary to design the NNWSI waste package. Scientific Investigations are configured to provide specific data for design inputs in the areas of parametric studies; requirements for the Advanced Conceptual Design phase; process development for disposal container fabrication, final closure, and nondestructive evaluation; and design validation through prototype testing. Studies that were undertaken prior to initiation of the work described herein have aided in scoping the current design task but are not discussed here.

44815 (UJV—7919-CH-B) Technical and economic evaluation of technology for treating waste water from special laundries of nuclear power plants. Franta, P.; Vanura, P.; Tarasova, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Aug 1987. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702955/JAW.

The technical and economic evaluation is given of two technological processes of treating waste water contaminated with radionuclides. The waste water is produced by washing clothes in special laundries of nuclear power plants with WWER type reactors. For both treatment processes, two modifications are taken into account in which two different detergents are used. The first one is a commercial detergent and the second one a detergent with improved decontamination ability. The process based on coprecipitation was found to be more advantageous from the economical angle; in both technological processes the same cleaning effect was reached at the same time. Savings of chemical materials by using special detergents will not be shown in total costs; the technological equipment costs and the construction costs are decisive. The costs of waste water treatment in a chemical treatment plant are compared with those of treatment by a distillation process. (author). 4 figs., 1 tab., 3 refs.

44816 (USGS-OFR—88-366) Bibliography of reports by US Geological Survey personnel on studies at the Nevada Test Site, released between January 1 and December 31, 1986. Glanzman, V.M. (Geological Survey, Denver, CO (USA)). 1988. Contract AI08-86NV10583. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013210/JAW.

Reports listed in this bibliography include information on underground nuclear testing and waste management projects at the Nevada Test Site (NTS). The bibliography is divided into reports regarding underground nuclear testing, and waste management studies for the Nevada Nuclear Waste Storage Investigations Project (NNWSI). Reports are listed in each category by publication outlet and number. The USS-474- series report pertain to underground nuclear testing studies, and are cross referenced to administrative (or in-house) series. The administrative series numbers are used to break down the USGS-474- series for more specific area identification.

44817 (YJT—87-21) Effects of fuel burn-up and cooling periods on thermal responses in a respository for spent nuclear fuels. Hautajaervi, A.; Anttila, M.; Taivassalo, V. (Technical Research Centre of Finland, Otaniemi. Nuclear Engineering Lab.). (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Dec 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754514/JAW.

Flexible methods and codes have been developed to calculate thermal responses in a spent nuclear fuel repository located in granitic bedrock. The thermal resistance of the backfill material makes an essential contribution to the temperature at the canister surface. The backfill is however so thin compared to the rock masses of the repository that a stationary solution for the temperature drop across the backfill can be used. Combining analytical solutions of thermal diffusion in the rock and the stationary temperature following the released heat power across the backfill gives a very good description of the thermal behaviour of a repository. Temperatures at different points in a repository were calculated for encapsuled spent fuel with different cooling times (10, 20, 30 and 40 years) and having different burn-up values (33, 35 and 45 MWd/kgU). The amount of spent fuel in each canister was supposed to originate from 1.4 tons of fresh Uranium in the calculated examples. A more crucial variable in a thermal analysis of a repository configuration is however the heat power of canisters as a function of time and not the content of canisters. The study shows that the largest temperature rise at the boundary of a centrally located canister and buffer mass will be at most 85 K with assumed thermal data, when the heat power of 900 canisters does not exceed 1200-1400 W each at the time of emplacement depending on burn-up and cooling time. Assuming a higher value for the heat conductivity of the buffer material corresponding to that of the water saturated bentonite gives 15% higher limits respectively. The canisters were supposed to be placed in 15 rows 25 m apart from each other and 60 canisters in each row. The distance between canisters was taken to be 6 m.

44818 (YJT—88-01) Interpretation of hydraulic interference tests. Pingoud, K.; Jaakkola, T.; Kuusela, A.; Ylinen, A. (Technical Research Centre of Finland, Espoo. Geotechnical Lab). (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jan 1988. 64p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754515/JAW.

In the report methods for interpreting hydraulic crosshole tests are presented. The objective of these tests is to study the groundwater movement and hydraulic properties of the crystalline bedrock for the planning of the nuclear waste disposal. For the interpretation of the hydraulic tests 2-D and 3-D finite element models for the groundwater flow process in bedrock were developed based on the porous media approach. As a case a long-term pumping test carried out in Olkiluoto power plant area was studied by the aid of the numerical models above. The finite element program Adinat was used in the numerical solution of the model equations. The first stage in the interpretation of the long-term hydraulic test is to form the basic mathematical model of the bedrock by the aid of earlier hydraulic tests, geophysical measurements and geological investigations. The crosshole test carried out is then simulated by the basic model and the simulation results are compared with the test data. After this comparison and the qualitative analysis of the test data the structure or parameters of the basic model are changed so that realistic model simulations are obtained. The results of the case study showed that the final numerical models developed could be used to the rough estimation of the hydraulic properties of the bedrock.

44819 **(YJT—88-06) Measuring methods of matrix diffusion. A literature study.** Muurinen, A.; Valkiainen, M. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Reaktorilaboratorio). (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Mar 1988. 64p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754518/JAW.

In Finland the spent nuclear fuel is planned to be disposed of at large depths in crystalline bedrock. The radionuclides which are dissolved in the groundwater may be able to diffuse into the micropores of the porous rock matrix and thus be withdrawn from the flowing water in the fractures. This phenomenon is called matrix diffusion. A review over matrix diffusion is presented in the study. The main interest is directed to the diffusion of non-sorbing species. The review covers diffusion experiments and measurements of porosity, pore size, specific surface area and water permeability.

44820 **Scientific basis for nuclear waste management 11: Volume 112: Proceedings.** Apted, M.J.; Westerman, R.E. (eds.). Pittsburgh, Pennsylvania; Materials Research Society (1987). 819p. Materials Research Society, 9800 McKnight Road, Suite 327, Pittsburgh, PA 15237.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (30 Nov 1987).

This book contains 74 reports on the scientific aspects of nuclear waste management. Divided into eight topical areas, the book contains papers discussing mathematical modeling of waste form solubilities, radionuclide migration, vitrification, grouting, corrosion, geochemistry, spent fuels, glasses, and nuclear waste facilities. (TEM)

44821 **Economics of defense high-level waste management in the United States.** Slate, S.C.; McDonell, W.R. (Pacific Northwest Lab., Richland, WA (US)). pp 37-42 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The Department of Energy (DOE) is responsible for managing defense high-level wastes (DHLW) from U.S. defense activities using environmentally safe and cost-effective methods. In parallel with its technical programs, the DOE is performing economic studies to ensure that costs are minimized. To illustrate the cost estimating techniques and to provide a sense of cost magnitude, the DHLW costs for the Savannah River Plant (SRP) are calculated. Since operations at SRP must be optimized within relatively fixed management practices, the estimation of incremental costs is emphasized. Treatment and disposal costs are shown to equally contribute to the incremental cost of almost $400,000/canister.

44822 **Applications of molten salts in plutonium processing.** Bowersox, D.F.; Christensen, D.C.; Williams, J.D. (Los Alamos National Lab., Los Alamos, NM (US)). pp 872-887 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Plutonium is efficiently recovered from scrap at Los Alamos by a series of chemical reactions and separations conducted at temperatures ranging from 700° to 900°C. These processes usually employ a molten salt or salt eutectic as a heat sink and/or reaction medium. Salts for these operations were selected early in the development cycle. The selection criteria are being reevaluated. In this article, the authors describe the processes now in use at Los Alamos and their studies of alternate salts and eutectics.

44823 **Waste generation reduction, volume reduction and disposal of low-level radioactive waste at the Idaho National Engineering Laboratory.** Bohrer, H.A.; Rodgers, A.D.; Uhl, D.L. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 143-150 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The Idaho National Engineering Laboratory is one of the Department of Energy's principal centers for conducting nuclear reactor research and development. It contains a wide range of nuclear facilities. This paper presents an overview of low-level waste management operations activities currently being conducted at the Idaho National Engineering Laboratory. These activities include waste generation reduction, waste volume reduction, waste disposal, compliance assurance, and environmental surveillance of low-level waste management activities.

44824 **Performance testing of high specific activity waste forms per 10 CFR part 61.** Neilson, R.M.; McConnell, J.W.; Rodgers, R.D. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 289-296 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The Low-Level Waste Data Base Development - EPICOR-II Resin/Liner Investigation Program of the U.S. Nuclear Regulatory Commission (NRC) is obtaining information on radioactive waste by means of NRC-prescribed tests in a disposal environment. This paper describes on the resin solidification task of that program and includes the current test status and results.

44825 **Applications of a standard leaching test for waste forms.** Godbee, H.W.; Anders, O.U. (Oak Ridge National Lab., Oak Ridge, TN (US)). pp 283-288 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The American National Standard, "Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short-Term Procedure," ANSI/ANS-16.1-1986, provides a uniform procedure to measure and index the release of nuclides from waste forms as a result of leaching. It provides a mathematical procedure for calculating a "Leachability Index" value from the test data. The merits and demerits of the procedure, based on several years of usage, are discussed. The results obtained for waste forms by this procedure are compared with the results obtained on specimens of the same waste form using the MCC-1 test protocol of the Materials Characterization Center of the U.S. Department of Energy.

44826 Future directions of defense programs high-level waste technology programs. Chee, T.C.; Shupe, M.W.; Turner, D.A.; Campbell, M.H. (U.S. Dept. of Energy, Office of Defense Waste and Transportation Management, Washington, DC (US)). pp 1-16 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The Department of Energy has been managing high-level waste from the production of nuclear materials for defense activities over the last forty years. An objective for the Defense Waste and Transportation Management program is to develop technology which ensures the safe, permanent disposal of all defense radioactive wastes. Technology programs are underway to address the long-term strategy for permanent disposal of high-level waste generated at each Department of Energy site. Technology is being developed for assessing the hazards, environmental impacts, and costs of each long-term disposal alternative for selection and implementation. This paper addresses key technology development areas, and consideration of recent regulatory requirements associated with the long-term management of defense radioactive high-level waste.

44827 Support of low-level waste operations at U.S. Department of Energy facilities. Chee, T.C.; Halford, D.K.; Jennrich, E.A. (U.S. Dept. of Energy, Washington, DC (US)). pp 65-68 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

The U.S. Department of Energy has disposed of low-level waste at its facilities by shallow land burial since the early 1940's. However, increased concern for safety and assurance of performance have caused questions on whether shallow land burial should be employed for future low-level waste disposal. Difficulty in demonstrating proper site characterization of existing facility locations as well as increasingly stringent siting requirements have resulted in consideration of a a management approach which reduces its reliance on the disposal site isolation capabilities alone. The Department's systems approach incorporates reliance on waste source reduction, waste treatment, and the disposal site to meet system performance/quality assurance objectives. Selection of specific treatment and disposal technologies is based on performance assessments which considers total activities and costs from waste generation through long-term maintenance of the disposal facility.

44828 Operating considerations for LLRW disposal. Jones, D.F. (Pacific Nuclear Systems, Inc., Federal Way, WA (US)). pp 409-412 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

Low Level Radwaste (LLRW) disposal sites have been in operation, in the United States, for the best part of two decads. The development and operation of these facilities underwent a significant change with the implementation of U.S. Nuclear Regulatory Commission Regulations (10CFR61) and enactment of the Low-Level Waste Policy Act of 1980 (as amended in 1985). The Policy Act would site LLRW disposal facilities in states and regions with hydro-geological conditions that may be less than optimum. In such circumstances, engineered barriers, specialized containers, and innovative procedures, would be required, as a strong preference to simple shallow land disposal. This paper addresses some of the primary considerations involved in the safe and effective operation of a LLRW disposal facility in the United States. The information is derived from operating experience during the past decade.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 44697, 44698, 44704, 44705, 44706, 44707, 44708, 44709, 44710, 44711, 44712, 44713, 44714, 44715, 44716, 44717, 44718, 44719, 44720, 44721, 44722, 44723, 44724, 44725, 44726, 44727, 44729, 44730, 44731, 44732, 44733, 44734, 44735, 44736, 44737, 44738, 44739, 44740, 44741, 44742, 44743, 44744, 44745, 44746, 44747, 44748, 44749, 44750, 44751, 44752, 44753, 44754, 44755, 44759, 44760, 44761, 44762, 44763, 44770, 44771, 44772, 44773, 44774, 44777, 44778, 44779, 44796, 44798, 44800, 44801, 44803, 44804, 44805, 44806, 44814, 44820, 44826, 44828, 44830

44829 Transporting TMI-2 core debris to INEL: Public safety and public response. Schmitt, R.C.; Reno, H.W.; Young, W.R.; Hamric, J.P.; Wade, T.E. (EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 369-374 of Proceedings of the 1987 international waste management conference. Oyen, L.C.; Platt, A.M.; Tosetti, R.J.; Feizollahi, F. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871102—).

From International waste management conference; Kowloon, China (29 Nov 1987).

This paper describes the approach taken by the U.S. Department of Energy (DOE) to ensure that public safety is maintained during transport of core debris from the Unit-2 reactor at the Three Mile Island Nuclear Power Station near Harrisburg, PA, to the Idaho National Engineering Laboratory near Idaho Falls, ID. It provides up-to-date information about public response to the transport action and discusses DOE's position on several institutional issues. The authors advise that planners of future transport operations be prepared for a multitude of comments from all levels of federal, state, and local governments, special interest groups, and private citizens. They also advise planners to keep meticulous records concerning all informational transactions.

0540 Health And Safety

REFER ALSO TO CITATION(S) 44700, 44703, 44768, 44773, 44800, 44829

44830 (DOE/UMT—0166) Project schedule and cost estimate report. (USDOE Albuquerque Operations Office, NM. Uranium Mill Tailings Remedial Action Project Office). Mar 1988. 285p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88013178/JAW.

All cost tables represent obligation dollars, at both a constant FY 1987 level and an estimated escalation level, and are based on the FY 1989 DOE Congressional Budget submittal of December 1987. The cost tables display the total UMTRA Project estimated costs, which include both Federal and state funding. The Total Estimated Cost (TEC) for the UMTRA Project is approximately $992.5 million (in 1987 escalated dollars). Project schedules have been developed that provide for Project completion by September 1994, subject to Congressional approval extending DOE's authorization under Public Law 95-604. The report contains site-specific demographic data, conceptual design assumptions, preliminary cost estimates, and site schedules. A general project overview is also presented, which includes a discussion of the basis for the schedule and cost estimates, contingency assumptions, work breakdown structure, and potential project risks. The schedules and cost estimates will be revised as necessary to reflect appropriate decisions relating to relocation of certain tailings piles, or other special design considerations or circumstances (such as revised EPA groundwater standards), and changes in the Project mission. 27 figs', 97 tabs.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 44697, 44821, 44825, 44826, 44828, 44829, 45520

44831 (BNL—40832) Timely information on safeguards equipment: Keeping "Safeguards instrumentation: A computer-based catalog" current. Auerbach, C.; Biittner, B.J.; Kirby, D.K. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-880631—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007399/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A second edition of "Safeguards Instrumentation: A Computer-Based Catalog" was published in 1985 by the Technical Support Organization (TSO) at Brookhaven National Laboratory (BNL) at the request of the US Department of Energy, Office of Safeguards and Security (DOE/OSS), International Safeguards Branch (the original sponsor). The object of the revision was to keep the information up-to-date, so as to assist in-field personnel in implementing effective safeguards, and DOE/OSS staff in long-range planning. Orientation and format of the original edition were left basically unchanged. A number of entries on new developments in safeguards instrumentation were added; many of the original entries were deleted or updated. The new edition provides information on 125 representative items in the "Materials Accountancy" and "Containment and Surveillance" categories. The document was generated from a database that had been developed for the original edition and that continues to be stored in a HP-3000 computer located at BNL. The database can be readily accessed by TSO personnel for updating or other modifications on a continuous basis. It may also be accessed, under certain conditions, by individuals outside BNL for information or searches. If kept up-to-date, the database provides a useful mechanism for keeping the safeguards community informed on developments in, and approximate cost of, relevant instrumentation, even in the absence of further printed editions of the "Catalog." 3 refs., 5 tabs.

44832 (DP-MS—88-36) Intrusion detection and access control at the Savannah River reactors. Reeve, H.R.; Cato, A.R.; Bell, T.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 5p. (CONF-880631—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012419/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

E.I. du Pont de Nemours and Company, prime contractor to the Department of Energy, currently operates three nuclear reactors for defense material production at the Savannah River Plant. A highly successful safeguards intrusion detection and access control system, in compliance with DOE Order 5632.4, has been in operation at the reactor sites since September 1984. This paper describes the three-sensor intrusion detection system and the three-parameter access control system, and it gives the maintenance experience for major system components based upon 6 system years of operation. Mean time between failure rates between 0.7 and 345.6 months have been experienced. Key points to the establishment of a successful maintenance program are discussed. 3 figs., 1 tab.

44833 (LA—11316-MS) Analysis of NDA [nondestructive assay] instrument calibration data. Sampson, T.E.; Goldman, A. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015060/JAW.

This report discusses some of the many items that must be considered when analyzing the calibration data form nondestructive assay (NDA) instrumentation. Evaluating the effect of calibration errors on materials control and accountability requires careful consideration of many factors. Some of the topics discussed are the types of calibration curves, general types of standards and their applicability to actual measured samples, and data acquisition. The report emphasizes that knowledge of the characteristics of the NDA instrumentation must be applied during the calibration data analysis procedure. Examples illustrating these effects are presented using actual calibration data from in-field instruments measuring highly enriched uranium. 2 refs., 15 figs., 1 tab.

44834 (LA-UR—88-1929) Modeling risk assessment for nuclear processing plants with LAVA [Los Alamos Vulnerability and Risk Assessment]. Smith, S.T.; Tisinger, R.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880631—39). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014445/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Using the Los Alamos Vulnerability and Risk Assessment (LAVA) methodology, we developed a model for assessing risks associated with nuclear processing plants. LAVA is a three-part systematic approach to risk assessment. The first part is the mathematical methodology; the second is the general personal computer-based software engine; and the third is the application itself. The methodology provides a framework for creating applications for the software engine to operate upon; all application-specific information is data. Using LAVA, we build knowledge-based expert systems to assess risks in applications systems comprising a subject system and a safeguards system. The subject system model is sets of threats, assets and undesirable outcomes. The safeguards system model is sets of safeguard functions for protecting the assets from the threats by preventing or ameliorating the undesirable outcomes, sets of safeguards subfunctions whose performance determine whether the function is adequate and complete, and sets of issues, appearing as interactive questionnaires, whose measures (in both monetary and linguistic terms) define both the weaknesses in the safeguards system and the potential costs of an undesirable outcome occurring. LAVA applications include our popular computer security application and applications for embedded systems, survivability systems, transborder data flow systems, property control system, and others. 7 refs., 4 figs.

44835 (SAND—87-1642/1v) An adaptable modular Safeguards Control and Communications System (SCCS) control and display subsystem: The operator's console and associated hardware. Ortiz, S.; Predika, L. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1988. Contract AC04-76DP00789. 270p. NTIS, PC A12. Order Number DE88011705/JAW.

Seven sets of hardware associated with either the operator's consoles or the host computers for the Safeguards Control and Communications System (SCCS) are described in this manual. The hardware complements include (1) the Tektronix 4125 graphics terminal and color cathode-ray tubes, (2) the switch group interface (SGI), (3) the audio-alarm horn, (4) the touch-sensitive panels, (5) the communications dataplexer, (6) the WWVB Clock, and (7) the RS-232 to RS-422 converter. This manual details all technical information necessary to maintain each of these components in this system. Where appropriate, additional documents have been referenced to provide the reader with a complete source of information for these hardware components. 7 figs., 4 tabs.

44836 (UCRL—98112) An integrated approach to validation of safeguards and security program performance. Altman, W.D.; Hunt, J.S.; Hockert, J.W. (Lawrence Livermore National Lab., CA (USA)). 26 Jun 1988. Contract W-7405-ENG-48. 9p. (CONF-880631—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013097/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

(DOE) requirements for safeguards and security programs are becoming increasingly performance oriented. Master Safeguards and Security Agreements specify performance levels for systems protecting DOE security interests. In order to measure and validate security system performance, Lawrence Livermore National Laboratory (LLNL) has developed cost effective validation tools and a comprehensive validation approach that synthesizes information gained from different activities such as force exercise, limited scope performance test, equipment testing, vulnerability analyses, and computer modeling; into an overall assessment of the performance of the protection system. The analytic approach employs logic diagrams adapted from the fault and event trees used in probabilistic risk assessment. The synthesis of the results from the various valida-

tion activities is accomplished using a method developed by LLNL, based upon Bayes's theorem. 7 refs., 3 figs.

44837 (UCRL—98141) Coping with subjectivity in vulnerability assessment models. Renis, T.A.; Cardwell, R.G. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1988. Contract W-7405-ENG-48. 8p. (CONF-880631—32). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014148/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Vulnerability assessment models are widely used to systematically evaluate the performance of complex safeguards systems against a variety of threats. These models require varying levels of detail and input data about the physical design of a facility and its safeguards operations and procedures. However, to evaluate safeguards effectiveness and give a performance rating, these models require additional performance data reflecting probabilities of detection, assessment, interruption, and neutralization, as well as the associated times for various adversary scenarios. These data may be attained from equipment design specification, laboratory testing, expert judgment, or component testing. Regardless of how these data are obtained, they are inherently subjective. Although vulnerability assessment models for safeguards performance evaluation rely on many subjective inputs, their results are extremely useful in identifying strengths and weaknesses in proposed and existing safeguards systems and in evaluating the benefit of proposed safeguards upgrades. Thus, in using vulnerability assessment models it is important to ensure the quality of subjective inputs and proper interpretation of the results. This paper addresses the uses of various vulnerability assessment models and the nature of subjectivity in those models. The paper also describes methods for coping with subjective data. 12 refs., 1 fig.

44838 (UCRL—98142) A new insider vulnerability assessment model. Sokkappa, P.R.; Renis, T.A. (Lawrence Livermore National Lab., CA (USA)). 22 Jun 1988. Contract W-7405-ENG-48. 6p. (CONF-880631—31). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014146/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A new insider vulnerability assessment model is currently being developed at Lawrence Livermore National Laboratory (LLNL). The model focuses on timely detection of theft or diversion of nuclear material by a non-violent insider. This model will be part of an integrated vulnerability assessment package being developed jointly by LLNL and Sandia National Laboratory. The model will enable a safeguards analyst to complete a comprehensive and well-documented vulnerability analysis. Two major components are used in the model. The first consists of a description of the facility being analyzed, the safeguards components in use at the facility, the theft material, and the potential insider adversaries. The second component is a predefined set of strategy definitions, including specific methods of defeating the individual safeguards components. It also contains the logic and equations necessary to determine which strategies apply to the various insider adversaries and to compute the associated detection probabilities. The optimal theft scenario and the overall probability of detection are determined for each type leads to consistency of results and ease of evaluation. The reports generated are designed to aid in identifying weaknesses and suggesting potential upgrades. Re-evaluation is simplified by the structure of the model. 1 ref., 5 figs.

44839 (WHC-SA—0168-FP) Application of EMCAS timeliness model to the safeguards facility interface: [Final report]. Eggers, R.F.; Giese, E.W. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1987. Contract AC06-87RL10930. 7p. (CONF-871110—26). NTIS, PC A02. Order Number DE88013675/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

This paper provides a method of computing the probability that a nuclear material control and accounting test will detect and insider theft of special nuclear material (SNM) in a timely fashion. Often, when nuclear facilities are evaluated for their ability to defend against this threat, the detection capability of the material accounting system is considered to be late. However, a careful examination of the adversary's most likely stealth and deceit scenarios shows that several hours or more are often required to move material beyond the protected area. If material accounting tests are conducted and verified before material leaves the protected area, they are timely. This paper shows how to compute the probability of timely detection by the material accounting system.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 44826, 44828, 44829

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

44840 (SAAS—357, pp 26-33) Experiences in radioisotope production in the German Democratic Republic with special reference to radiopharmaceuticals. Muenze, R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

Radioisotope production has been carried out in the German Democratic Republic for 30 years. Based on a 10 MW research reactor, a cyclotron and certain irradiation facilities at units of national nuclear power stations, a widespread assortment of radioisotopes is produced with emphasis to radiopharmaceuticals as the main materials. Domestic production covers the national demand in these products where the production is technologically feasible under our conditions. A complete supply of the users in the country (more than 7000 licences) is accomplished by an intense co-operation with neighbouring countries, including mutual assistance in reactor shut down periods and supply with special radioactive materials and products. International co-operation within the framework of the IAEA takes place, mainly as scientific and technological assistance to many developing countries.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 44808

44841 (CONF-880911—8) Reactor physics calculations for the control of the advanced neutron source reactor. Difilippo, F.C.; Abu-Shehadeh, M.; Perez, R.B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012942/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Efficient production of extremely high fluxes requires compact cores with consequent high power densities and initial excess reactivities. Strong space dependent neutron spectras and limited access to the small core are other characteristics that make design of the control system of these type of facilities an interesting problem. We present calculations of the worths of ^{10}B to reduce the initial excess reactivity, the worth of Hf and B control rods, and the neutron lifetimes, for the case of candidate designs for the Advanced Neutron Source reactor. 4 refs., 4 figs., 2 tabs.

44842 (ENEA-RT-DISP—87-4) 1984 Summary of data relative to radioactive substances: ENEA (Italy) report. Dobici, F.; Lavorante, F.; Puccini, A.; Vuolo, M. (ENEA, Rome (Italy)). Dec 1987. 95 p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754248/JAW.

The summary was prepared by ENEA, the Italian Commission for Alternative and Energy Sources. Declared data concerning 88 radioisotopes were reported. Various tables showed the notifica-

tions and relative activities in the fields of medicine, industry and research in various Italian Regions.

44843 (LA-UR—88-1976) **Calculated {alpha}-induced thick target neutron yields and spectra, with comparison to measured data.** Wilson, W.B.; Bozoian, M.; Perry, R.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880546—30). NTIS, PC A02. Order Number DE88014438/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

One component of the neutron source associated with the decay of actinide nuclides in many environments is due to the interaction of decay {alpha} particles in ({alpha},n) reactions on low Z nuclides. Measurements of ({alpha},n) thick target neutron yields and associated neutron spectra have been made for only a few combinations of {alpha} energy and target nuclide or mixtures of actinide and target nuclides. Calculations of thick target neutron yields and spectra with the SOURCES code require {alpha}-energy-dependent cross sections for ({alpha},n) reactions, as well as branching fractions leading to the energetically possible levels of the product nuclides. A library of these data has been accumulated for target nuclides of Z {le} 15 using that available from measurements and from recent GNASH code calculations. SOURCES, assuming neutrons to be emitted isotopically in the center-of-mass system, uses libraries of {alpha} stopping cross sections, ({alpha},n) reaction cross reactions, product nuclide level branching fractions, and actinide decay {alpha} spectra to calculate thick target ({alpha},n) yields and neutron spectra for homogeneous combinations of nuclides. The code also calculates the thick target yield and angle intergrated neutron spectrum produced by {alpha}-particle beams on targets of homogeneous mixtures of nuclides. Illustrative calculated results are given and comparisons are made with measured thick target yields and spectra. 50 refs., 1 fig., 2 tabs.

44844 (SAAS—357, pp 34-53) **Radioactive isotope and radiation application in the German Democratic Republic.** Leonhardt, J.W.; Wetzel, K.G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

The current status in radioisotope and radiation application in the GDR is exemplified for the following most important industrial branches: energetics (radiometric coal ash monitors, radiotracer optimization of power stations), natural resources (radiation protected wells, irradiation of waste cellulose, isotope ratios in natural gas prospection), microelectronics (radiographic imaging of impurities on wafer surfaces), agriculture (food irradiation, tracer techniques by /sup 15/N), chemistry (radiation induced chlorination of PVC, radiotracer optimization of a caprolactame plant), environment (ionization detectors for pollutants in the air, X-ray analyzer of pollutants in water), historical objects (radiation treatment of parquet in the Palace of Sanssouci, characterization of porcelain).

08 HYDROGEN

0801 Production

44845 (NEDOJ—8703, pp 460-474) **Study on elements of power generation system using refined methanol.** Nagaya, Yoshikazu. (Hitachi Zosen Corp., Osaka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

For a gas turbine power generation system using a methanol refining - water feeding - regeneration cycle, a study on catalysts for methanol refining, suitable reactors and refined gas combustors is carried out in pursuit of developing a low-cost, high-efficiency practical system that can operate under varying load. This report also presents results of a test for heat resistance of a zeolite catalyst carrying a Cu-ZnO-Al_2O_3 or Cu-Ni-Al_2O_3 material which have a heterogeneous porous structure, or a nickel-potassium material which has a homogeneous porous structure. Investigations are made on the design and dynamic characteristics of heat recovery and reaction processes. A test is made with a test apparatus incorporating these processes. Based on an conceptual methanol-refining type power generation system, a bench-scale combustor is designed and constructed and a combustion test is made using methanol and simulated refined methanol gas, to evaluate design methods for and characteristics of gas turbine combusters that use refined methanol gas. (10 figs, 4 tabs, 2 refs)

0802 Storage

REFER ALSO TO CITATION(S) 45211

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 44673

44846 (ANL/CNSV-TM—205) **Bioconversion of municipal solid waste and recovery of short-chain organic acids for liquid fuels production.** Antonopoulos, A.A.; Wene, E.G. (Argonne National Lab., IL (USA)). May 1988. Contract W-31109-ENG-38. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013967/JAW.

The purpose of this investigation is to determine the feasibility of bioprocessing municipal solid waste (MSW) to produce organic acids and recover the acids for hydrocarbon fuels production. This work has focused on acid production from anaerobic digestion of a simulated MSW material and a densified refuse-derived-fuels MSW substrate using 5-L continuously stirred and 12-L packed-bed anaerobic digesters. Methane generation was inhibited by heat treatment, addition of a methanogen-inhibiting compound, low pH, inoculum from a long-term acid-adapted culture, and short retention times. Steady-state operation was reached with acid concentrations of 15,000 to 18,000 mg/L. Nitrogen supplements to the feedstock increased volatile acid concentrations to between 27,000 and 30,000 mg/L. Extraction of digester fluids containing 15,000 mg/L total acids with trioctylphosphine oxide in heptane recovered more than 82% of the acid in a single extraction. Work continues on maximizing the acid production and recovery from anaerobically digested MSW substrate. 56 refs., 17 figs., 3 tabs.

44847 (CONF-8110374—1) **Biogas - its production and use.** (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Agrartechnik; Landesanstalt fuer Landwirtschaftliches Maschinen- und Bauwesen, Stuttgart (Germany, F.R.)). 1981. 137p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770240/JAW.

From Seminar on agricultural technology, construction, preventive care of the environment for training and consulting staff in the agricultural administration; Hohenheim, F.R. Germany (13 Oct 1981).

The report is about the fundamentals of biogas technology, the set-up and function of different types of plant, safety demands, hygienic and manuring aspects, as well as storage and the possibilities for use of biogas. (EF)

44848 (DOE/PC/79935—4) **Circulation in gas-slurry column reactors: Second quarterly report, quarter ending March 31, 1988.** Clark, N.; Kuhlman, J.; Celik, I. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). 1988. Contract FG22-87PC79935. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013080/JAW.

In this quarter the 20cm diameter laboratory bubble column has been constructed and tested with air-water operation. Theory has been developed based on experimental measurement of bubble shapes to predict bubble size distribution from probe measurements. In addition, an experimental technique for acquiring a global force

balance on a bubble column has been used and data from this work are currently being processed. Numerical simulation of two phase systems has commenced. 12 refs., 16 figs.

44849 **(DOE/PC/90533—6) Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, December 16, 1987-March 15, 1988.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 12 Jul 1988. Contract FG22-86PC90533. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013760/JAW.

Further progress was made in the construction of a computer-automated reactor system to be used in the kinetic and deactivation studies. Progress was made in the calibration of flow meter, tracing of electrical lines, and drawing of schematics. Efforts were made toward the development of the control language and control routines and toward debugging of software, work was also initiated on the operating manual. Modifications to the fixed bed microreactor system for independently varying hydrogen and CO concentrations were finished and checked out. CO hydrogenation activity/selectivity tests were conducted on unsupported iron catalysts reduced at 300 for 400degreeC. Deactivation leading to loss of surface area was experienced after rereduction at 400degreeC and/or exposure to air. 47 refs.

44850 **(EUR—11237) Methanization of sugarcane molasses stillage using the SGN fixed-film process at Societe industrielle de sucrerie--Guadeloupe (French West Indies): Demonstration project.** Arnoux, M.; Michelot, E. (Commission of the European Communities, Luxembourg; Societe Generale pour les Techniques Nouvelles (S.G.N.), 78 - Saint-Quentin-en-Yvelines (France)). 1988. 34p. (FR;EN). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012634/JAW.

Methanization of industrial biowastes reduces pollution of the receiving wastewater (COD and BOD_5) while producing energy. The SGN fixed-film process has been implemented on an industrial scale in Guadeloupe (French West Indies) for methanization of sugarcane molasses stillage, after validation at a pilot facility. The potential worldwide benefits are considerable because environmental pollution is particularly severe at all plants distilling sugarcane molasses to obtain ethanol fuel. 6 figs., 1 tab.

44851 **(LUTKDH/TKKA—7004-1-56(1985)) Concentration of biogas by gaspermeation.** Harrysson, A.C. (Lund Inst. of Tech. (Sweden). Dept. of Chemical Engineering). Nov 1985. 59p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753698/JAW.

A literature survey is made about possibilities to use gaspermeation for the concentration of biogas. Following conclusions can be made: -Commercial equipment is available on the market. -A few small plants are in operation. -The method is economically advantageous in comparison with other methods. -The separation costs are about 0.02-0.04 SEK/kWh produced methan. With 44 refs.

44852 (NEDOJ—8703, pp 416-436) **Development of high-performance composite separating membrane for methane producing equipment. Development of new bioreactor for methane fermentation.** Futaka, Mitsugu. (Kobe Steel, Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This paper presents the development of separating membrane composite bioreactor for producing methane initiated in FY 1986. The target gasification rates of organic matters fed were 80% or more and 60% or more for the high-to-medium-concentration and low-concentration waste waters, respectively. The progress of investigation on the carrier used in the bioreactor and microorganisms participating in the methane fermentation was described. Adjusting the pH value in the reactor was indispensable. Since the organic matters contained in waste water are hydrolyzed, dehydrogenated and decarbonated by bacteria into lower organic acids and gas, there is a process having two vessels in which the production of organic acids and gasification are carried out separately. It is required for increasing the gasification rate to solubilize and materialize the solid organic matters. Based on the heat balance, it is economically undesirable to heat the low-concentration waste water. The results obtained so far indicate that the bacteria and undecomposed matters may be prevented from flowing out of the system by adding the membrane unit to improve the capability and gasification rate, though the effect of membrane composite on the gasification rate is not so high. (3 figs, 12 tabs, 8 photos)

44853 (NEDOJ—8703, pp 437-459) **Development of high-performance composite separating membrane for methane producing equipment. Development of membrane module for methane fermentation.** Kuwamoto, Yasuo. (Kubota, Ltd., Osaka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The developmental research was initiated in FY 1986. This paper presents the state of development of the membrane module for methane fermentation in the first year. The low-pressure and energy-saving type membrane module is required because the conventional one consumes a lot of power. It was confirmed by the experiment that the microorganism-immobilized membrane module belonging to the organic membrane type forms the layer of microorganisms on the surface, which decompose the organic matters in waste water and that the surface of membrane can be regenerated. The basic structure of the external-pressure type polysulphone material was understood from the capillary type membrane module. Among the hollow-yarn membrane module belonging to the external-pressure type, the hollow-yarn made by Mitsubishi Rayon showed the highest performance. The external-pressure tubular type membrane module belonging to the inorganic membrane type has a header for dipping the membrane into the bioreactor. It was made on an experimental basis and experimented. The internal pressure tubular type comprises a lot of ceramic membrane tubes with a I.D. of 4 to 8 mm which are put in a casing. The effectiveness of the concept of system was suggested by the fluid systems of gas/liquid phases and gas/liquid/solid phases. The plate type comprises the laminated flat membranes like a filter press. Experiment was made using a small model of module. (13 figs, 5 tabs)

44854 **(NLVF/S—686) Recovery of compost heat II. Final report.** Hanssen, J.F. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Dec 1986. 16p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753712/JAW.

The report deals with the recovery of compost heat. The aim of the project has been as follows: To study various process parameters affecting the aerobic conversion of manure, supply of organic materials, storage intervals, oxygen supply, and utilization of surplus heat; to collect and publish the results from a project on the production and utilization of biogas. New approaches are briefly discussed. 5 drawings, 2 tables.

44855 **(NP—8770241) Biogas from liquid swine manure - results at the Stoeckhof plant.** Scheurer, E. (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Agrartechnik; Landesanstalt fuer Landwirtschaftliches Maschinen- und Bauwesen, Stuttgart (Germany, F.R.)). Oct 1983. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770241/JAW.

This plant, which functions according to the principle of the fermenting canal, has worked for two years without any disturbances worth mentioning. The plant has a comparably fair gas yield. Calculations proved the plant to be just economically efficient under the condition of direct combustion of the biogas. Assuming its utilization in power-and-heat cogeneration, the same calculation, using the figures of energy yield during the first year of operation, proved negative. (orig./EF)

44856 **(NP—8770242) Biogas - establishing process parameters in two biogas plants of different size.** Enssle, G. (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Agrartechnik; Landesanstalt fuer Landwirtschaftliches Maschinen- und Bauwesen, Stuttgart (Germany, F.R.)). Jul 1981. 47p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770242/JAW.

In two biomass conversion plants of different size, process parameters were established. The plants are upright, insulated steel containers with internal heat exchangers and hydraulic stirring devices. Both plants were operated according to the flow principle in the mesophilic temperature range. For two different retention times - 33 days and 22 days - the following data were established: specific gas yield (gas yield referred to 1 head of large cattle, - to 1 cubic metre of liquid manure, - to a volume of digestion substrate, - to added organic mass, - to decomposed organic mass), gas composition, and degree of decomposition of the organic substance. Furthermore, the amount of energy needed to maintain the digestion process was established. (orig./EF)

44857 **(NP—8770247) Disproportion of organic wastes into biogas by means of a tow-stage, thermophilic fermentation process. Final report.** Troesch, W. (Fraunhofer-Institut fuer Grenzflaechen- und Bioverfahrenstechnik (IGB), Stuttgart (Germany, F.R.)). Apr 1985. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770247/JAW.

The work carried through in the period of report January 1 - December 31, 1985 comprised the following: Impacts of the composition of the synthetic substrate on the space-and-time-related yield of microbial methane production, and further experiments for the characterization of screened methanogenic bacteria. Screening for co-cultures decomposing propionic acid was taken up, in order to elucidate problems encountered in tracing the decomposition paths of propionic acid in mixed cultures. Comparative experiments were conducted with different reactor configurations for obtaining methane from cow and bullock liquid manures; these provided new results in comparison with data published, as far as gas yield and gas productivity as a function of space load are concerned. (orig.)

44858 **(NP—8770315) Anaerobic waste water purification and biogas production in a pulsed bioreactor.** Hwang, K.Y. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Verfahrenstechnik). 18 Dec 1986. 136p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770315/JAW.

The author's experiments were carried out in a novel type of bioreactor. In view of the advantages in the anaerobic process (high concentrations of biomass), the microorganisms were retained inside the bioreactor by fixation on a carrier. To avoid the problems otherwise encountered in bioreactors with fixed bacteria, in the pulsed bioreactor the block of foamed polymer carrying the bacteria is moved upwards and downwards in a single period at longer intervals of time. The reactor geometry and the pulsed movement assure a uniform and strong flow through the carrier material; gas bubbles are quickly removed from the bacterial surfaces and led out of the bioreactor, thus ensuring uniform bacterial supply and discharge. The biochemical conversion rate was determined using a highly burdened liquid filtrate waste. The conversion rate and gas productivity were found to be a function of the time of residue and room burden.

44859 **(PB—88-193370/XAB) Granulation in Upflow Anaerobic Sludge Blanket reactor.** Hoaki, T.; Tomozawa, T.; Kaneko, S. (Taisei Corp., Tokyo (Japan). Technical Research Inst.). 1987. 9p. NTIS, PC E09/MF A01.

Text in Japanese; Included in Taisei Technical Research Report, No. 20, 27-34(1987).

The experiment was designed to study Upflow Anaerobic Sludge Blanket (UASB) reactor and to evaluate a methane fermentation process for the treatment of waste water. The essential feature of the UASB process is high activity of anaerobic bacterial mass in the reactor which forms granular sludge. The system has a higher specific loading rate and superior settling properties of granular sludge.

44860 **(PB—88-208871/XAB) Photoelectrochemical reduction of carbon dioxide. Final report, May 1984-August 1987.** Wass, J.C.; Chandrasekaran, K.; O'M, J. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). Dec 1987. 104p. NTIS, PC A06.

See also PB—87-148771; Portions of this document are not fully legible.

The reversible redox potential for reduction of carbon dioxide to CO is -0.103 V NHE at pH 0. Although the overpotential for the photoelectrochemical reduction of carbon dioxide is decreased by 700 mV compared to electrochemical reduction on indium, still the rate of the reaction is slow. It was thought that surface states at the semiconductor-electrolyte interface are responsible for low efficiency. Determination of surface states under illumination was carried out using the impedance technique. Density of surface states as a function of potential were calculated. Surface states are induced by adsorbed species at the interface. The authors investigated the absorption of radicals, ions, and neutral molecules at the surface of the electrode using Fourier-transformation infrared spectroscopy. Electrocatalysts were been used to increase the rate of the reaction. The relationship between the structure of the islets and the catalytic effect is discussed. A new catalyst, 18-crown-6 ether has been used for the reduction of carbon dioxide, yielding CH3OH as a product.

44861 **(PB—88-216825/XAB) Reduction of CO_2 to methanol and methane by photo and dark reactions on semiconductor and metal electrodes. Annual report, March 1, 1987-March 1, 1988.** Frese, K.W.; Summers, D.P.; Kim, J.J.; Cinibulk, M. (SRI International, Menlo Park, CA (USA)). Mar 1988. 65p. NTIS, PC A04/MF A01.

See also PB—87-226825.

SRI is pursuing fundamental research directed at activating Cl species that have a potential role in gas-industry processes. During the previous year, SRI advanced the understanding and performance of aqueous CO_2 reduction to CH_4 at inexpensive copper electrodes. The advances included use of an HCl surface pretreatment that doubles the rate of CH_4 formation; rationalization of the effects of different surface pretreatments; analysis of product distributions as a function of voltage and other parameters; identification of CO_2 as the electroactive species; interpretation of the reactivity difference between CO and CO_2 reduction; development of a mechanistic model that explains the catalytic properties of Cu, predicts the voltage for onset of CH_4 formation, and suggests other catalytic systems for investigation; determination of the crystal orientation dependence of CH_4 formation; rationalization of the effect of plating rate on Cu activity; and, preliminary investigations of other catalyst systems. The current rate of CH_4 formation is 2 cu ft/sq ft day. During the following year SRI will investigate: the effect of various Cu surface alterations on CH_4 formation, and other catalytic systems for producing CH_4 at lower voltage.

44862 **(STEV-FGT—88-3) Biogasification LTH. Progress report 880331.** Andersson, L.; Hallgren, A. (Statens Energiverk, Stockholm (Sweden)). 6 Apr 1988. 39p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753725/JAW.

The report describes a model for the calculation of heat transfer and residence time for gas and particles in a falling tube. A literature survey on the separation of H/sub 2/S at high temperature, is included. Gasification experiments of biomass in a bench-scale falling tube have been started. (G.B.)

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 44845

44863 **(DOE/FE/05121—1956) Preliminary scale-up design and economic study of methanol production based on high rate entrained flow coal gasification.** (Mountain Fuel Resources, Inc., Salt Lake City, UT (USA); Lummus Crest, Inc., Bloomfield, NJ (USA); Ford, Bacon and Davis, Inc., New York (USA)). Oct 1985. Contract AC21-81FE05121. 283p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE86001943/JAW.

Engineering design and economic studies were conducted of three sizes of plants for producing methanol from coal via advanced entrained flow gasification followed by conventional methanol synthesis. The advanced coal gasification technology being developed by Mountain Fuel Resources was employed as the basis for this study. The plant production capacities were 7 million, 70 million, and 200 million gallons per year. Ford, Bacon and Davis, Inc. performed engineering design, drafting, and cost estimating for the coal receiving, coal preparation, and coal gasification areas. Similar work on the gas purification and chemical processing downstream of the gasifier and the plant utilities was performed by Lummus Crest, Inc. Mountain Fuel Resources performed the economic studies. Total capital required for the three plants was estimated to be $33.6 million, $299 million, and $565 million. The estimated cost of methanol production was estimated to be $1.45 per gallon, $0.99 per gallon, and $0.68 per gallon. The production cost for the largest plant was favorable compared to the current selling price for methanol from a recently constructed natural gas based plant.

44864 **(DOE/PC/80012—T12) Biological production of fuels from coal-derived gases: Quarterly report, April 20, 1987-June 20, 1987.** (Arkansas Univ., Fayetteville (USA)). 1987. Contract AC22-85PC80012. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012129/JAW.

Three major developments occurred during the period of April, 1987-June 20, 1987 which will aid in the development of a culture capable of producing liquid fuels from the components of synthesis gas. First, the mixed culture developed from chicken waste in the University of Arkansas laboratories has been purified by dilution and tentatively classified as a member of the Clostridium species. Secondly, laboratory techniques were developed to yield quantitative fermentation results by following an inert component in the gas phase during the fermentation. Finally, various techniques for eliminating or minimizing acetate as a by-product in ethanol production from CO in synthesis gas were presented and discussed. 5 refs., 3 figs., 1 tab.

44865 (NEDOJ—8703, pp 396-409) **Technical development of alcohol fuel. Searching and breeding of superior bacteria.** Nakada, Toshiyuki. (Hitachi Zosen Corp., Osaka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The technology of the conversion of biomass to available energy has been developed. Recently, the biomass has shifted from yeast to Zymomonas SP (Z). This paper presents the findings of the searching and breeding of Z in FY 1986. The ethanol productivity of both African and South Asian separated-strains was poorer than that of the standard domesticated strain. Those strains produce less ethanol in the ethanol fermentation also in the culture medium of waste molasses of cane than the standard strain. This is because the concentration of salt in the waste molasses increases with increasing of the concentration of sugar. Although Z was domesticated by the waste molasses to improve the salt resistance of separated strains, no salt-resistant strain was obtained. The impartment of xylose fermentability has been studied by the procedure of genetic engineering to extend the range of fermentable sugars aiming at the cloning and introduction to Z of xylose-metabolic enzyme gene and the generation of the promoter-selecting vector. However, it has not been developed yet. (4 figs, 6 tabs, 13 refs)

44866 (NEDOJ—8703, pp 410-415) **Technical development of alcohol fuel. Research and development for total system.** Uchida, Masahiro. (Takara Shuzo Co., Ltd., Kyoto, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This paper presents the findings obtained in FY 1986 for the technical development of alcohol for fuel. A batchwise pulverizer was used for the pretreatment test. When cedar wood was treated with liquid and gaseous auxiliaries and then pulverized with steam of 29 kg/cm^2, the saccharification rate by the cellulase formulation was 78% at the highest. In order to effectively remove the lignin from the pulverized cedar wood and recover the feed stock for fermentation, it is effective to treat it with dioxane or DMF. The pulverization of cedar wood without auxiliary was carried out by a small multi-stage pulverizer. The saccharification rate as high as 88.5% was obtained under the optimum conditions of 40 kg/cm^2 of treating steam pressure and ten minutes of treating time. A small plant for the continuous pulverization and recovering of feed stock for fermentation was manufactured on an experimental basis. The material balance and consumption of utilities in the whole process of pulverization-cleaning-fermentation-distillation were calculated from the test results. The saccharification rate was remarkably improved by investigating the use of auxiliary and the steam treating pressure. (2 figs, 1 tab)

44867 **(NP—8770238) Regionally differentiated analysis of the production cost of bioethanol.** Koegl, H. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany, F.R.). Inst. fuer Betriebswirtschaft). 1986. 82p. (In German). NTIS (US Sales Only), PC A05. Order Number DE88770238/JAW.

The work establishes the regional competitiveness and differentiation of the production cost of bioethanol. The conditions examined and data used show the southern German regions to be at a clear advantage. Owing to the great importance of raw material prices for the production cost of renewable raw materials, regional differentiation seems indispensable. Such investigations are an important precondition for making the necessary assessment with regard to the overall economy. (EF)

44868 **Expression of solvent-forming enzymes and onset of solvent production in batch cultures of Clostridium beijerinckii (Clostridium butylicum).** Yan, R.T.; Zhu, C.; Golemboski, C.; Chen, J.S. (Virginia Polytechnic Institute and State Univ., Blacksburg (USA)). *Applied and Environmental Microbiology;* **54**: No. 3, 642-648(Mar 1988). Contract FG05-85ER13368.

Clostridium beijerinckii (Clostridium butylicum) NRRL B592 and NRRL B593 were grown in batch cultures without pH control. The use of more sensitive and accurate procedures for the determination of solvents in cultures led to the recognition of the onset of solvent production about 2 h earlier than the previously assigned point and at a higher culture pH for both strains. Reliable assays for solvent-forming enzyme activities in cell extracts have also been developed. The results showed that activities of solvent-forming enzymes in strain NRRL B592 started to increase about 1 h before the measured onset of solvent production and that the increase in activities of solvent-forming enzymes was not simultaneous. The degree of increase of these enzyme activities for both strains ranged from 2- to 165-fold, with acetoacetate decarboxylase and butanol-isopropanol dehydrogenase showing the largest activity increases. However, the pattern of increase of enzyme activities differed significantly in the two strains of C. beijerinckii. When an increase in solvent-forming enzyme activities was first detected in strain NRRL B592, the culture pH was at 5.7 and the concentrations of total acetic and butyric acids were 5.2 and 3.6 mM, respectively. For strain NRRL B593, the corresponding pH was 5.5. Thus, the culture conditions immediately preceding the expression of solvent-forming enzyme activities differed significantly from those that have been correlated with the production of solvents at later stages of growth.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 44936, 45137, 45295, 45660

44869 **(NEI-NO—42) Production and use of charcoal in Norway.** Nagoda, L. (Norges Landbrukshoegskole, Aas. Inst. for Treteknologi). 1984. 14p. (In Norwegian). (CONF-8404342—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753700/JAW.

From Seminar on charcoal combustion in a steel kiln-Boen Bruk A/S; Iveit, Norway (11 Apr 1984).

The report deals with the production and use of charcoal in Norway. Following aspects are presented: Facts on charcoal such as the chemical composition and energy potentional; the utilization of charcoal for various purposes; utilization of by-products; supply- and consumption rates together with costs. 1 drawing, 5 tables.

44870 **(NP—8770226) Economy of different methods to produce pellets/briquettes from straw, bark, waste wood, saw mill residues, waste paper and mixed raw materials for use in small furnaces. Final report - materials volume.** Kolloch, P.; Schmittinger, B.; Ortmaier, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1987. 111p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770226/JAW.

The report lists producers of presses, heating systems and furnaces, as well as characteristic data of these. Experience in straw and bark briquetting is reported. (EF)

13 HYDRO ENERGY

1301 Resources And Availability

44871 (NEI-NO—40, pp 13) **Ranking hydroelectric power station projects with multicriteria decision analysis.** Wenstoep, F.E.; Carlsen, A.J. Jan 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE88752092/JAW. (CONF-8605333—Vol.2).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

The paper deals with ranking methods for hydroelectric power station projects with multicriteria decision analysis. 540 hydroelectric power projects are ranked by two methods. The first method is formal but improvised and leads to a ranking list which is backed by the Norwegian Government. The other is based on multicriteria decision making and made to throw critical light on the first one. The paper explains the differences and discusses the political and analytical reasons for them. 11 drawings, 2 tables.

1307 Power-conversion Systems

44872 **(NP—8770346) Experimental investigations of losses on the wheel side of radial high-pressure hydraulic turbines.** Geis, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 5 Jun 1985. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770346/JAW.

The dissertation discusses the performance of high-power hydraulic turbines. Losses on the wheel side are determined both experimentally and theoretically along with their influencing parameters. Practical applications of the measured results are discussed. (HAG).

44873 **(STF—11A87044) Heat recovery from the cooling water at Tunnsjoedal kraftverk.** Eggen, G. (SINTEF, Trondheim (Norway)). Jul 1987. 24p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753731/JAW.

The report deals with the use of heat pumps and heat exchanges for the recovery of heat from the cooling water at the Tunnsjoedal hydroelectric power station (Norway). A technical/economical evaluation is given for the heating of greenhouses and the process water heating for fish hatcheries. A combined system of greenhouses/hatcheries seems to be the most beneficial arrangement. 8 drawings, 2 tables.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 44545

1401 Resources And Availability

44874 **A statistical analysis of 400 sites to determine the major factors affecting solar access in the Portland metropolitan area.** Kaufmann, J. (Oregon Dept. of Energy, 625 Marion Street NE, Salem, OR (US)). pp 89-93 of Proceedings of the 12th passive solar conference. Andrejko, D.A.; Hayes, J. Boulder, CO; American Solar Energy Society (1987). (CONF-870711—).

From Solar '87: 12th national passive solar conference; Portland, OR, USA (12 Jul 1987).

Twenty-one (21) local governments in the four-county, two-state Portland metropolitan area are engaged in a joint project to adopt a consistent set of solar access standard. In 1986, Portland became the largest U.S. city to protect solar access in new subdivisions, infill development, and retrofit situations. About 20 other Oregon communities have adopted solar ordinances. This project is the first time solar access has been considered for an entire metropolitan area. The project was funded by the Bonneville Power Administration (BPA), and is being administered by the Oregon Department of Energy (ODOE). A major task of the project is technical research. A site analysis of 400 randomly selected homes was conducted for solar access. The purpose is to identify the extent of solar access available/lost under typical development patterns, and the main factors affecting solar access. The findings will form the basis for policy recommendations, and will be used to help estimate potential savings. Other project research and activities, including a public attitudes survey, an analysis of the effectiveness of existing ordinances, several subdivision redesigns, workshops for the development community and general public, and others will bear on the recommendations as well.

1404 Environmental, Legal, And Institutional Aspects

44875 **Trends in worker's compensation in the United States.** Clausen, T. (Solar Energy Research Institute, Golden, CO 80401). *AIP (American Institute of Physics) Conference Proceedings;* **166**: No. 1, 219-228(15 Jul 1988). (CONF-880112—).

From Photovoltaics safety conference; Denver, CO, USA (19 Jan 1988).

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 44847, 44854, 44855, 44856, 44857, 44858, 44862, 44867, 44868, 44870, 45294, 45705, 45800, 45897, 45898

44876 **(CONF-8506393—) National forest inventory in Europe.** Pelz, D.R.; Cunia, T. (eds.). (Freiburg Univ. (Germany, F.R.). Abt. fuer Forstliche Biometrie). 1985. 333p. (In German and English). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

National forest inventories are being conducted or planned in most European countries. The systems used vary both in statistical design and organisation and are described in these proceedings. Separate abstracts were prepared for 17 papers in this report. (KG)

44877 (CONF-8506393—, pp 1-19) **Main objectives and desirable characteristics of national forest inventory systems.** Cunia, T. (State Univ. of New York, Syracuse (USA). Coll. of Environmental Science and Forestry). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The term of regional or national forest inventories was defined. The fundamental statistical questions for planning and realization of inventories are explained and discussed. (KG)

44878 (CONF-8506393—, pp 20-29) **Sampling designs for national forest inventories.** Pelz, D.R. 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The optimal combination of sampling methods will vary with place and time; forest conditions, the given objectives of the inventory, restrictions in personnel, finances and time will limit the choices available. In general an inventory design for large scale forest inventories should take advantage of auxiliary information,

especially with multiphase sampling and its use of remote sensing techniques We can expect an tremendous increase in efficiency, sampling with varying probabilities esp. PPS sampling applied to the different phases can increase efficiency further. With respect to the time element inventories should be planned to be permanent with permanent plots that are remeasured at each occasion either completed or partially. (orig./KG)

44879 (CONF-8506393—, pp 30-35) **Goals and general concepts of a national forest statistics.** Schoepfer, W. 1985. (In German). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The general conception of the inquiry procedure, some error-theoretical aspects of large-scale statistics, and the mathematical and statistical fundamentals of the tree specific volume calculation are presented. The West German national forest statistics is to help assess forest productivity and production possibilities and detect large-area forest damage. (orig./KG)

44880 (CONF-8506393—, pp 36-70) **Swedish national forest inventory. A brief description.** Eriksson, B. (Swedish Univ. of Agricultural Sciences, Umeaa. Dept. of Forest Survey). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

In 1983 a new method was introduced as a basis for the Swedish National Forest Inventory. The new inventory is based on both permanent and temporary plots. The design is systematic cluster sampling with partial replacement of plots. The information recorded comprises both site, stand and tree data. All data is recorded by portable micro-computers directly in the field and transmitted by telephone to a big computer at the head-office. The inventory is based on field sampling only, but the use of satellite data might be integrated in the future. (orig.)

44881 (CONF-8506393—, pp 71-82) **National forest inventory in Finland.** Kuusela, K. (Forest Research Inst., Helsinki (Finland)). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Finnish program of forest inventories is introduced. Its main purpose is to take forestal measures and to deliver marketing informations and not to ascertain the extent of forest-decline. (KG)

44882 (CONF-8506393—, pp 83-105) **Austrian forest inventories.** Haszprunar, J. 1985. (In German). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The development of forest inventories in Austria, their parameters and methods are as well explained as the gained results. The extensive program is described in detail. (KG)

44883 (CONF-8506393—, pp 106-122) **Methodology and execution of the Swiss national forest inventory.** Mahrer, F. (Eidgenoessisches Inst. fuer Waldforschung, Birmensdorf (Switzerland)). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Swiss National Forest Inventory is described in detail. The goals of the forest policy can be summarized under three headings: 1. To maintain the area of forest and its spatial distribution. 2. To ensure management for sustained yield. 3. To promote the establishment of infrastructure and to help forest enterprises to become self-supporting. The inventory methods are explained. (KG)

44884 (CONF-8506393—, pp 123-126) **Hungarian national forest inventory.** Gaspar-Hantos, G. 1985. (In German). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Hungarian national forest inventory, its aims and methods are outlined. The results are used to estimate productivity of forest areas and the degree of forest decline. (KG)

44885 (CONF-8506393—, pp 127-137) **French national forest inventory.** Balleydier, R.; Chevrou, R.B. (Inventaire Forestier National, 34 - Lattes (France)). 1985. (In French). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The objectives and the methods of the French national forest inventory are quite the same than those used in many other countries. Main objective is to estimate future production of the forests in quantities and qualities of wood products. Methods are three stage sampling with stratification and several degrees in the last stage: photo-interpretation of the sample points on aerial photographs, ground control of the interpretation, ground survey of plots for volumes and growth. (orig./KG)

44886 (CONF-8506393—, pp 138-150) **Forest inventory in Luxembourg.** Schram, P. 1985. (In German). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The methods of forest inventory in Luxembourg are outlined. The results are used to estimate productivity of forest areas and the degree of forest decline. (KG)

44887 (CONF-8506393—, pp 151-162) **Fourth national forest inventory in the Netherlands.** Daamen, W.P.; Ritskes, T.M.; Jansen, J.J.; Schoonderwoerd, H. (State Forest Service, Utrecht (Netherlands). Dept. of Statistics; Landbouwhogeschool Wageningen (Netherlands). Dept. of Forest Management). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Fourth National Forest Inventory in the Netherlands will provide data to evaluate the functioning of the forest with regard to timber production, nature conservation and recreational use. Attention is also given to the woody plantations in the rural areas of the country. By carrying out an area census, all forest stands are mapped and several characteristics have been registered. After completion of the area census, 3,300 permanent plots have been established for the collection of data on growing stock and current increment, vegetation type, management activities, recreational parameters and vitality conditions. (orig./KG)

44888 (CONF-8506393—, pp 163-169) **Outline of a regional forest inventory in Belgium.** Rondeux, J. (Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium). Centre de Recherche et de Promotion Forestiere). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

This paper outlines the first forest inventory recently carried out in the southern part of Belgium (Wallonia) where the forests cover about 530.000 hectares (or 33% of the regional area). The main objective was to estimate the standing volume of timber in the present conditions and to give, quickly, information dealing with the areas occupied according to different classifications. The inventory system used is based on temporary systematic sampling with an intensity of one plot per 50 hectares. (orig.)

44889 (CONF-8506393—, pp 170-178) **Second national forest inventory of Spain.** Millan, F.J.M. 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Forest Administration has decided to initiate the Second National Inventory to be done between 1985-1994, and to be repeated every ten years, - having the field sampling plots a permanent character. Each inventory year approximately a tenth of the tree area is covered, including complete autonomous entities. As a background for area estimations and as help for the adoption of policies in the Forestry Sector, a computerized geographic information system, called Sistema de Informacion Forestal Nacional (SINFONA) will be created. This system will be mantained and actualized by means of aerial photographs and satellite imagery. The field sampling plots will be distributed over the forest area on the basis of the UTM kilometric grid. (orig./KG)

44890 (CONF-8506393—, pp 179-187) **Italian forest inventory.** Caruso, C.; Tosi, V. 1985. (In German). NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Italian Ministry of Agriculture and Forestry has arranged for the compiling of a National Inventory of Forests. This study, commensurate with the present-day forest conditions of Italy, has been carried out by Forest and Range Management Institute. A desire to accomplish this inventory in as short a time as possible, coupled with a shortage of funds, led our researchers to adopt a method of systematic sampling over a single groundphase, with a limited sampling intensity (one point per 900 hectares). At the moment the data are being processed electronically, and the inventory will probably not be ready before next year. (orig./KG)

44891 (CONF-8506393—, pp 188-198) **Portuguese forest inventory.** Carvalho Oliveira, A.M.M. de. (Universidade Tecnica, Lisbon (Portugal)). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Portuguese National Forest Inventory system is presented. Some comments are made about its results and difficulties of elaboration. Sampling design is refered to. (orig.)

44892 (CONF-8506393—, pp 199-201) **Forest inventory in Greece.** Mastroyannakis, H. (Ministry of Agriculture, Athens (Greece). Inventory and Cartographic Dept.). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The Greece National Forest Inventory system is presented. Its methods of remote sensing are explained and briefly discussed. (KG)

44893 (CONF-8506393—, pp 238-247) **Accuracy and relative efficiency of Landsat data and orthophotos for determining area and volume of spruce.** Stellingwerf, D.A.; Sann Lwin. (International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands)). 1985. NTIS (US Sales Only), PC A15. Order Number DE88770229/JAW.

From Meeting on national forest inventory systems in Europe; Freiburg im Breisgau, F.R. Germany (10 Jun 1985).

Mitteilungen der Abteilung fuer Forstliche Biometrie, Universitaet Freiburg.; No. 85-3.

The accuracy of Landsat photos for measurements of area and volume of spruce was determined. For this issue data gained by Landsat pictures were compared with areas from orthophotos and both with field data. The use of Landsat data for determining spruce timber volume, with a two-stage sampling method, is expected to become less expensive than the use of orthophotos for areas of about 1500 km/sup 2/ and larger. (orig.)

44894 (NEDOJ—8703, pp 60-83) **Development of technique for sheet-type substrate process.** Maeda, Yasuhiro. (Hoxan Corp., Sapporo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

As part of a project seeking a low-cost, mass production lines for solar cell panels, a technique for sheet-type substrate process is developed. By this technique, a rotational centrifugal force is applied to molten silicon to directly produce square polycrystalline sheets of 10 x 10 cm. Mold modules for forming a set of four square silicon plates at a time are designed. Horizontal-type and vertical-type modules are compared and the horizontal-type is selected in consideration of its quality and performance for mass production. Furthermore, a single-cavity-type module is developed to increase mass production performance. Optimum rotational frequency of a module is 200-300 rpm and throughput of an apparatus is 4 min 30 sec. An apparatus for mass-producing sheet-type substrates which can produce 1,000 sheets per day is developed. Silicon sheets of various crystal structures can be produced by controlling the temperature of the mold module. Their characteristics also vary largely depending mainly on their crystal structures. (29 figs, 5 tabs)

44895 (NEDOJ—8703, pp 84-101) **Study on practical use of amorphous solar. Manufacturing technique for high quality product.** Fujikawa, Kyoichiro. (Mitsubishi Electric Corp., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The practical use of a three-layer amorphous solar cell was studied. The increase of product was attained by increasing the density of Ge-H bond as well as decreasing the density of Si-H_2 bond by the diluted hydrogen plasma CVD method to improve the quality of a-SiGe membrane. The requirements for attaining the target efficiency were obtained by the computer simulation. Voc was able to be remarkably increased by increasing the band gap of microcrystalline SiP layer in the A-Si pin cell, decreasing the activation energy and optimizing the condition of i-layer membrane. The characteristics of bottom layer of a-SiGe pin cell were improved by inserting the interfacial buffer layer of p/i and N/i. As a result, the actual efficiency reached 9.22% and the output was 35.4 W in the NEDO-sized module. It became clear that the decrease of the internal stress in membrane is indispensable to the restraint of photo-deterioration. (1 tab, 16 refs)

44896 (NEDOJ—8703, pp 102-120) **Research on practical application of amorphous solar cell. Techniques for producing large-area cell.** Sakai, Hiroshi. (Fuji Electric Corporate Research and Development, Ltd., Kanagawa, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

As part of research on practical application of amorphous solar cells, a study is made in pursuit of techniques for producing solar cells with a large area. Investigation on the production of large-area a-Si layers is focused on techniques for high-quality a-Si layer formation, including a radical-control a-Si layers formation method. To determine the optimum area of solar cells, an apparatus that can produce a-Si layers on a substrate with an area up to 40 cm x 120 cm is designed and constructed, and layer production testing is made using the apparatus. Seeking to develop highly-efficient large-area cell production methods, an effort is made to improve the characteristics of the p/i interface and the properties of doped layers to increase the conversion efficiency of pin-type cells. An attempt is also made to determine the optimum shape of the transparent conductive layer surfaces to maximize the light confinement performance. These techniques are used to design and produce a submodule with an area of 30 cm x 40 cm, which is found to have a conversion efficiency of 8.1 percent. An a-Si layer structure evaluation technique using laser is developed to provide a tool for evaluating the layers produced. (17 figs, 1 tab)

44897 (NEDOJ—8703, pp 121-139) **Research and development of photothermal hybrid type solar power generation system.** Nakanishi, Eisuke. (Komatsu Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

A solar power generation system to be mounted on a house is designed and constructed using a hybrid panel for collecting electricity and heat. The solar cell unit in the hybrid panel consists of an SOG polycrystalline silicon wafer, developed by the New Energy Development Organization, and tandem-pattern electrodes formed on both sides of the wafer. The electrode-free portions can transmits sunlight of large wavelengths above 1,000 nm. the solar collector is of a black liquid type, which uses a black working medium for heat transfer. The use of a black liquid as working medium can increase the efficiency since it directly absorbs heat. The black liquid employed is a black antifreezing solution made up of a propylene glycol solution containing dispersed fine particles of activated charcoal. The solar cells and the liquid are separated in the hybrid panel developed. Under the conditions of an atmospheric temperature of 28.0°C and a solar radiation quantity of 1 kW/m², the total efficiency of the panel is greater than 60 percent, or six times that of the solar cells used independently. (19 figs, 5 tabs)

44898 (NLVF/S—687) **Establishment and production of firewood under various vegetation conditions. Final report.** Opdahl, H. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Feb 1987. 15p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753713/JAW.

The report concerns the establishment and production of energy forests under various growth conditions. A calculation method for the quantification of future earnings and quantity of energy in a particular area is given. The experimental scheme for the mountain birch in the area of Alvdal-Roeros in the county of Oppland (Norway) is given. New approaches are briefly discussed. 1 drawing, 4 tables.

44899 (NLVF/S—688) **Economic analyses of increased use of energy from biomass.** Lunnan, A. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Feb 1987. 13p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753714/JAW.

The report discusses energy from biomass, and presents economic analyses of the increased use of biomass in Norway. In addition, the report emphasizes various conditions being important carriers. The following approaches are briefly compared: Analysis on the practice of framing; marketing analysis on raw materials; quantification of the value of preparedness for energy projects. 1 table.

44900 (NP—8770221) **Investigations on the water content in the sapwood of healthy and diseased spruce. Final report.** Schulz, H.; Boehner, G. (Bayerische Forstliche Versuchs- und Forschungsanstalt, Muenchen (Germany, F.R.)). 30 Aug 1987. 27p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770221/JAW.

213 spruces stems from 18 forestry commissions were cut up into 462 discs at different stem heights to determine the moisture distribution between the outermost stem portion and the pith. Similar investigations were carried out on a total of 197 discs taken from 56 pine stems from 6 forestry commissions. In cross-sections of healthy spruce the percentage water saturation differs characteristically in average values at stem heights of 5, 10 and 15 m from that of pine. However, there is considerable variation between individual stems. Average width of pith was determined to lie around 50 mm for both wood species. There were no statistically significant differences in moisture content for spruce of damage classes 0, 1 and 2 for the outer 15 mm sapwood zone. Spruce of damage classes 0, 1 and 3 showed an average water saturation of 87% with an insignificantly lower value of 85% for damage class 3 (differences as compared to damage classes 0 and 1 at 95% degree of confidence. With progressive damage class the sapwood zone tended to decrease on the average by about 5 mm from one damage class to the next. In pine increasing damage showed the same, if less pronounced, tendencies towards changes. Here too, the effects of damage on sapwood development were most noticeable, but remained far below those on spruce with an average decrease of 2 mm from one damage class to the next. Blue stain was only observed in the sapwood of a few spruce trees of damage class 4 where moisture content had already been noticeably reduced. (orig.) With 6 refs., 2 tabs., 7 figs.

44901 (NP—8770277) **Ethanol production with a flocculating mutant of Zymomonas mobilis and immobilized glycoside hydrolases.** Tramm-Werner, S. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 25 May 1987. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770277/JAW.

A method to extend the substrate spectrum of Z. mobilis was developed. Higher ethanol yields were achieved by simultaneous use of hydrolases cross-linked with glutar aldehyde together with the flocculating Zymomonas cells (TW 602). Apart from the high product yields, the method is characterized by low susceptibility to infections.

44902 (NP—8770282) **Purification of gaseous waste using fixed bacterial cultures.** Hauk, G. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 2 Feb 1987. 186p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770282/JAW.

Fundamental studies on the use of immobilized microorganisms are presented. Organic off-gas constituents are oxidized by bacterial monocultures fixed on carriers, i.e. granulated carbon-A. The studies were carried out in a counterflow trickle-bed reactor. The main subjects of research were: Immobilisation of bacteria, adsorption of pollutants, identification of the parameter determining the reaction rate, performance measurements in the trickle-bed reactor, and a comparison of the purification efficiency of free and fixed cells. (MBC).

44903 (SERI/STR—211-3350) **Research on amorphous-silicon-based thin-film photovoltaic devices: Semiannual subcontract report, 1 July 1987–31 December 1987.** Bottenberg, W.; Mitchell, K.; Wieting, R. (Solar Energy Research Inst., Golden, CO (USA); ARCO Solar, Inc., Camarillo, CA (USA)). May 1988. Contract AC02-83CH10093. 98p. NTIS, PC A06. Order Number DE88001169/JAW.

The objective of this work is to develop 13% (aperture area) efficient, 850-cm² four-terminal hybrid tandem submodules. The module design consists of a copper-indium-diselenide (CIS)-based bottom circuit and a semitransparent, thin-film silicon-hydrogen (TFS)-based top circuit. High-performance, semitransparent TFS devices and submodules were fabricated in which ZnO was used in the front and rear transparent conductors. High-performance CIS devices and submodules were also fabricated; however, the location and nature of the junction are not yet understood. Representative four-terminal hybrid tandem devices and submodules were fabricated from TFS and CIS component circuits. Optical coupling between the circuits was lower than expected, because of reflection losses at key interfaces. Efficiencies obtained for these devices and

modules include 14.17% for a four-terminal, 4-cm² tandem cell and 12.3% for a four-terminal, tandem module. 7 refs., 90 figs.

44904 **(SERI/STR—211-3351) Research on amorphous silicon-germanium alloys for tandem solar cells: Annual subcontract report, 1 July 1986--31 August 1987.** Paul, W.; Mackenzie, K.D. (Solar Energy Research Inst., Golden, CO (USA); Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). May 1988. Contract AC02-83CH10093. 70p. NTIS, PC A04. Order Number DE88001168/JAW.

The objective of this work is to explore the deposition conditions necessary to produce amorphous Si-Ge alloys with a band gap near 1.3 to 1.4 eV whose photo-electronic properties will be comparable to those of a-Si:H. It is essential to understand why the photoconductivity of a-Si/sub 1-x/Ge/sub x/:H:F is superior to that of a-Si/sub 1-x/Ge/sub x/:H, while most of the commonly measured optical and electronic properties remain unchanged. The focus of this investigation was on deposition conditions and on the microstructure of the films as revealed by transmission electron microscopy, gas evolution, and differential scanning calorimetry, concentrating on alloys with a high Ge content. Films were made both by glow discharge and by photochemical vapor deposition in a new type of apparatus. Structure, very important in determining photoelectronic properties, depends on the totality of the deposition parameter, and it is therefore important to understand the conditions in the plasma and at the interface of the growing film, when SiH_4, GeH_4, and H_2 are present in different concentrations, whatever the method of deposition. 3 refs., 8 figs., 2 tabs.

44905 **Technique for predicting the solvent-producing ability of Clostridium acetobutylicum.** Adler, H.I.; Crow, W. (Oak Ridge National Lab., TN (USA)). *Applied and Environmental Microbiology;* 53: No. 10, 2496-2499(Oct 1987). Contract AC05-84OR21400.

Changes in colony morphology were associated with the degeneration of solvent-producing strains of Clostridium acetobutylicum. The most efficient solvent-producing strains gave rise exclusively to colonies with dense centers containing large numbers of spores. Many outgrowths of various morphologies developed from the perimeter of such colonies after several days of incubation. The most degenerate cultures did not produce solvents and gave rise to large diffuse colonies that did not contain spores. These diffuse colonies did not produce outgrowth. Intermediate colony types were also observed. These could be derived from liquid cultures that were relatively poor solvent producers or from the outgrowths of colonies of efficient solvent-producing strains. Some of these intermediate types produced spores but did so less frequently than the high-solvent-producing strains. The spores of the intermediate types could not be distinguished from those of the most efficient solvent producers on the basis of heat sensitivity. The relationship observed between colony morphology and solvent production provides a method for predicting the solvent-producing potential of C. acetobutylicum cultures.

44906 **Point contact silicon solar cells.** Swanson, R.M.; Sinton, R.A. (Stanford Univ., CA (USA)). pp 742-748 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

A new type of silicon concentrator solar cell has been developed. It is called the point-contact cell because the metal semiconductor contacts are restricted to an array of small points on the back of the cell. The point-contact cell has recently demonstrated 22 percent conversion efficiency at one sun and 27.5 percent at 100 suns under an AM1.5 spectrum. 8 figs., 3 refs.

44907 **The superlinear behavior of short-circuit current in silicon concentrator cells at concentrations up to 1400 suns.** Zirkle, T.E.; Dondero, R.C.; Backus, C.E.; Schroder, D.K. (Arizona State Univ., Tempe (USA)). pp 749-753 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

Superlinearity data is reported for five different Si concentrator solar cells. Maximum superlinearity reported is 8.2%, at 800 suns on a p+/n/n+.3 ohm-cm cell. Analysis indicates that an electric field in the base region is responsible for the observed superlinearity. 3 figs., 12 refs., 1 tab.

44908 **Progress in photovoltaic concentrator research.** Arvizu, D.E. (Sandia National Labs., Albuquerque, NM (USA)). pp 771-780 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

Recent progress in photovoltaic concentrator research is reviewed. Since the Sixth European Communities photovoltaic solar energy conference in April, 1985, several exciting new developments have been reported. New record efficiency concentrator silicon cells have been reported at Stanford University, with 28% efficient high resistivity cells, and at the University of New South Wales, with near 25% efficient low resistivity cells. Both also report record 22% one-sun efficiencies. Compound semiconductor cells have also made advances. Research on multijunction devices has led to a mechanically stacked concentrator cell with near 27% efficiency. Module improvements have taken the form of reduced cost and better component reliability. In addition, a research emphasis is the development of new prototype modules that use the new laboratory cell advances. Array efforts have centered around improving the tracking and control subsystems in accuracy, durability, and cost. Today, concentrator systems in high insolation areas are being offered at prices near $4/W/sub p/ ac for large MW sizes and at prices below those of flat plate systems ($8/W/sub p/) in hundred kW sizes. These achievements are reviewed and the potential is discussed for concentrator technology to become a viable cost-effective bulk electrical power option. 8 figs., 8 refs.

44909 **Crystalline silicon photovoltaic arrays. A final summary of Flat-Plate Solar Array (FSA) Project work (1975-1986).** Callaghan, W.T. (Jet Propulsion Lab., Pasadena, CA (USA)). pp 792-799 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

The Flat-Plate Solar Array (FSA) Project, sponsored by the U.S. Department of Energy and managed by the Jet Propulsion Laboratory, has conducted research on a wide range of photovoltaic (PV) module technologies for over 11 years. Progress is summarized over this period for silicon feedstock refinement, sheet substrate formation, cost reduction, high-efficiency solar cell and process sequence development, engineering sciences, and module testing. An overall assessment is presented that summarizes the contribution over the past 11 years made by the FSA Project to the PV community. The FSA Project ended its work in September, 1986. 10 refs., 2 tabs.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 45223

44910 **A review of the chemical and physical properties of molten alkali nitrate salts and their effect on materials used for solar central receivers.** Bradshaw, R.W.; Carling, R.W. (Sandia National Labs., Livermore, CA (US)). pp 959-969 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Sandia National Laboratories, Livermore (SNLL), has been responsible for developing thermal energy collection and storage technologies for solar central receiver (SCR) applications as the lead laboratory designated by the U.S. Department of Energy. The

focus of one of these efforts has been the evaluation of the properties of a mixture of sodium nitrate and potassium nitrate as a single-phase working fluid for SCR systems. This paper summarizes the results of a comprehensive research program that was established by SNLL to address issues relevant to the use of molten nitrates at temperatures up to 600°C. It was concluded that molten nitrate salt is technically feasible as a working fluid for advanced SCR and offers a number of advantages compared to alternative fluids.

44911 **Viscosity measurements: Molten ternary carbonate eutectic.** Ejima, T.; Sato, Y.; Yamamura, T.; Tamai, K.; Hasebe, M.; Bohn, M.S.; Janz, G.J. (Dept. of Metallurgy, Faculty of Engineering, Tohoku Univ., Sendai 980 (JP)). pp 317-323 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Modelling calculations of falling molten salt films in direct absorption solar energy receivers led directly to questions concerning the reliability of the viscosity data for the ternary carbonate eutectic. The present work was undertaken to resolve this dilemma. A number of performance problems were encountered. The resolution of these and the results for viscosity measurements to 900°C for this molten carbonate system are reported. The results differ markedly from the earlier work, and possible reasons for this are examined.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 45255

44912 **(EUR—11194) Solar-heated swimming pool {open←quote}De Thermen{close←quote} at Alphen aan den Rijn: Demonstration project: Final report.** Van Winsen, G.H. (Commission of the European Communities, Luxembourg). 1987. 91p. (EN;DU). NTIS (US Sales Only), PC A05; 1; GPO Dep. Order Number DE88012638/JAW.

During construction of the indoor swimming pool "De Therman", a solar energy plant was erected on the roof. The intended result of this was the heating of swimming pool water which would lead to a decrease in the consumption of natural gas. It was also meant that the aim of local government to achieve saving of energy by way of making use of alternative energy, would also suit the purpose of setting an example.

44913 **(EUR—11278) Highlands Close group solar heating system (cost-effective group solar heating): Demonstration project: Final report, June 1986.** Maw, R.; Boyd, D.; Thring, J.; Cooper, P.; Gill, A. (Commission of the European Communities, Luxembourg; Polytechnic of Central London (UK)). 1988. 35p. NTIS (US Sales Only), PC A03. Order Number DE88012633/JAW.

This report follows the successful completion of the largest group solar heating system serving individual dwellings in the UK. Solar collectors, intergrated into the roofs of seven houses, feed a central water heat store which supplies space and water heating to eight flats and water heating to seven houses. The report describes the system design, the first year's operation and the capital costs. Some useful lessons are derived from the design, installation and monitoring phases. The system was designed by the Built Environment Research Group (BERG) of the Polytechnic of Central London (PCL), with architects David Ford Associates and the London Borough of Islington and the PCL, with help from the London Energy and Employment Network (LEEN). 8 refs., 9 figs., 10 tabs.

44914 (NEDOJ—8703, pp 140-160) **Development of fixed heat process type system. Development of drier system using air for heat collection.** Miyoshi, Akira. (Sumitomo Metal Industries Ltd., Osaka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

A wood drier system equipped with a solar collector which uses air for heat collection is constructed in Hokkaido and subjected to a demonstration test. The collector consists of a heat insulator laid over the bottom of a rectangular framework, and a carbon fiber (CF) sheet, i.e. heat collecting material, on top of it. Additional several CF sheets are provided in the space between the bottom and the upper covering, extending from the bottom slantly upward to block the air stream. Performance testing reveals that it has a heat collecting efficiency surpassing the target value of 50 percent. This is achieved because the thermal conductivity of the CF sheets is about 10 times as large as that of air in conventional plate-forced convection systems. The design of the wood drier system is based on calculation of the area of the collector. The demonstration plant constructed consists of two rooms, each having a capacity of 11 m^3. Heat load and heat loss are calculated to determine the quantity of heat required for drying. A slanting angle of 45° and heat collecting area of 112 m^2 are adopted. The appropriateness of this area is confirmed by testing and the construction costs are found to roughly meet the target value. (22 figs, 7 tabs, 3 photos)

44915 **(OUP—88-01) Solar energy at the Department of Physics, University of Oslo.** (Oslo Univ. (Norway). Fysisk Inst.). Jan 1988. 60p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753716/JAW.

The report recounts and presents the solar energy projects at the Oslo University (Norway) in 1987. The following projects are dealt with as follows: Testing of new types of measuring instruments and data recording in a University building; calculations and drafts for an industrial drying plant; construction and testing of a drying plant in an old barn; data recording for the houses at Soltun in the county of Oestfold (norway). 20 drawings, 1 table.

44916 **The sizing and control of backup heating systems in passive solar buildings.** Wray, W.O.; Best, E.D. (Los Alamos National Lab., Los Alamos, NM (US)). pp 59-68 of Proceedings of the 12th passive solar conference. Andrejko, D.A.; Hayes, J. Boulder, CO; American Solar Energy Society (1987). (CONF-870711—).

From Solar '87: 12th national passive solar conference; Portland, OR, USA (12 Jul 1987).

A procedure for sizing backup heating systems in passive solar buildings has been developed. The new procedure accounts for the beneficial effects of solar heat gains and building thermal inertia yet reduces to the standard ASHRAE method for sizing heatings systems when applied to nonsolar buildings of light construction. Based on the analysis presented in this report it appears certain that well-designed passive solar buildings may employ backup heating systems that are significantly smaller than the ASHRAE method would suggest. Money saved by employing a smaller heating system can greatly reduce the initial cost of a passive solar system thereby reducing the payback period on energy savings. Although primarily intended for single-family detached residences, the sizing procedure presented here may also be used to obtain an estimate of heat load requirements in multi-family dwelling and in small office buildings. The effect of significant internal heat sources, which does complicate the situation in larger buildings, is accounted for in the sizing procedure.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 44897, 44914

44917 **(EUR—11277) Advanced solar collectors for water heating: Final report, June 1987.** Williams, G.J.; Hayward, K. (Commission of the European Communities, Luxembourg; GEC Research Ltd., Leicester (UK). Engineering Research Centre). 1988. 71p. NTIS (US Sales Only), PC A05; 1; GPO Dep. Order Number DE88012628/JAW.

Under a contract from the European Commission - Energy Conservation Demonstration Programme, a solar water heating scheme, using advanced evacuated tube type collectors, has been installed to serve the GEC site canteen at Whetstone, Leicester in the United Kingdom. The scheme uses fin and tube type evacuated tube collectors having a total effective absorption area of 50 m^2

supplying water directly to a 2500 litre pre-heat storage tankWater is taken from the storage tank to calorifiers where, if necessary, auxiliary heat is supplied to achieve the final use temperature of 60{degree}C. The mean water demand of the system is some 3750 litres/day. The system has been in operation since June 1984 and a detailed monitoring exercise was carried out from September 1984 to June 1986. It was found that the canteen water demand had a good match to the solar radiation profile and a solar system yearly average efficiency of 38% was achieved. The associated solar contribution was around 24% of system demand, again on a yearly average basis. In practical terms the system performed well experiencing only minor difficulties. Some 1.6% of the tubes failed due to loss of vacuum during the life of the project. A comprehensive economic analysis is presented. This indicates that the present "retrofit" system cannot be considered an economic proposition against existing site energy cost. However, energy cost structures on other sites may be more favourable. Also, marked improvements to the unit energy cost emerge if the system is specified at the early stage of a new building. Non-UK areas, such as Southern France and Italy, benefit from significantly greater availability of solar energy which can have the unit energy costs. 7 refs., 26 figs., 7 tabs.

15 GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 44545

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 44922, 44923

44918 (NEDOJ—8703, pp 251-272) **Development of technique for hot-dry-rock power generation system.** Kuriyagawa, Michio. (New Energy Development Organization, Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

In pursuit of developing hot-dry-rock techniques, an exploratory well was bored and an artificial reservoir was produced by hydraulic fracturing in the Hijiore area of Yamagata prefecture. A high-pressure lubricating water pump was used to inject 1,080 m^3 of water into a 14 m-long bare portion at the well bottom (1788-1802 m deep), and the location and size of the artificial reservoir produced were determined from acoustic emission (AE) measurements. Observations showed that an artificial reservoir had been successfully produced in a deep hot-dry-rock bed by water injection. A fracture occurred at a depth of 1789 and at the well bottom. Fracture mapping based on AE measurements indicated that the fractures grew roughly in the southwest-northeast direction, with an inclination toward the northeast. The radius of the fractures was found to be about 250 m. Return water continued to flow out for 12 hours. Its volume was about 380 m^3, corresponding to about 35% of the water injected. Its maximum temperature was 105°C. After the stop of water injection, return water contained an increased concentration of Cl^- and the rock bed interstitial water was also found to be contained.(18 figs, 1 tab, 1 photo)

44919 **(NEDOJ-P—8307) Survey on the geomagnetic and earth current method detection technology.** (Geothermal Energy Research and Development Co. Ltd., Tokyo (Japan)). Mar 1984. 156p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754194/JAW.

Technical survey was conducted on the MT method (Earth Magnetic Current Method) which is recently spotlighted as a means of geothermal detection. Any practical technology of MT method is not now available in Japan, and the foreign technology is being utilized. However, it does not always fit to the special conditions. Therefore, we examined the measuring instruments, data proceeing technology, analysis technology, and economy. We have set a target for MT method development which could fit the unique situation of the Japanese geothermal area. It was found that this target could meet the Japanese conditions better than the conventional MT technology of the various companies.

44920 **The U.S. hot dry rock geothermal energy development program.** Franke, P.R. (Los Alamos National Lab., Los Alamos, NM (US)). pp 11-16 of Geothermal energy symposium. New York, NY; American Society of Mechanical Engineers (1988). (CONF-880104—).

From 11. annual energy-sources technology conference and exhibition; New Orleans, LA, USA (10 Jan 1988).

Recent accomplishments of the program are highlighted by a successful limited term flow test of the Phase II reservoir at the Fenton Hill site near Los Alamos. This reservoir connection was established by sidetracking one of the deep wells into hydraulically fractured areas, identified by microseismic data after original fracture attempts failed to connect the two wells. Hydraulic communication was improved by supplemental fracturing. Preliminary testing indicated a reservoir with fracture volume and heat production area surpassing the values from the earlier Phase I reservoir. Following completion of the downhole reservoir system, preparations were made for a reservoir-energy-extraction test. This Initial Closed Loop Flow Test (ICFT) was needed to obtain operating characteristics for planning a much longer test for thorough reservoir evaluation. The 30-day ICFT succeeded with final production of about 10 MWt at 192°C, while injecting 285 gpm at 4600 psi and producing 206 gpm at 500 psi. The water loss rate and flow impedance were high, 27% and 18 psi/gpm respectively, but were declining. Radioactive tracer tests indicated reservoir volume growth during the experiment which was continuously monitored for acoustic or microseismic activity. Following the flow test, experiments were continued for several months during the vending process. Preparations are now underway for the Long Term Flow Test (LTFT). To understand as much as possible about the Phase II reservoir and to demonstrate the commercial feasibility of energy from HDR reservoirs, a flow test of approximately one year's duration is deemed necessary. Part of the preparation for the LTFT is the workover and repair of the production well and the installation of a competent overall flow loop and energy exchange system.

1502 Geology And Hydrology Of Geothermal Systems

44921 **Uranium-series age determination of calcite veins, VC-1 drill core, Valles Caldera, New Mexico.** Sturchio, N.C. (Argonne National Laboratory, Argonne, Illinois). *Journal of Geophysical Research;* **93**: No. B6, 6097-6102(10 Jun 1988).

Uranium-series analysis (/sup 238/U--/sup 234/U--/sup 230/Th) of 13 calcite veins from the hydrothermally altered Madera Limestone in the VC-1 drill core was performed to determine the ages of the veins and their relation to the Valles hydrothermal system. Thermal water from VC-1 and two hot springs in San Diego Canyon was analyzed for U and (/sup 234/U//sup 238/U) to help evaluate the constancy of initial (/sup 234/U//sup 238/U). The (/sup 230/Th//sup 234/U) age of one of the veins is {similar←to}95 kyr, and those of two other veins are {similar←to}230 and {similar←to}250 kyr. Five of the veins have near equilibrium (/sup 230/Th//sup 234/U) and are probably older than {similar←to}0.3 m.y. Uranium concentrations in the remaining veins are too low for analysis by the α-spectrometry techniques employed in this study. Of the five veins near (/sup 230/Th//sup 234/U) equilibrium, suggesting ages greater than {similar←to}1.0 m.y., but one has (/sup 234/U//sup 238/U) = 1.15, suggesting an age between {similar←to}0.3 and {similar←to}1.0 m.y. Calculated initial (/sup 234/U//sup 238/U) of the veins yielding relatively young ages are neither equal to each other nor to (/sup 234/U//sup 238/U) in thermal water from VC-1, indicating inconstancy of initial (/sup 234/U//sup 238/U) tht may be related to variations in groundwater mixing proportions. Three of the four veins that yield relatively young ages consist of coarse, sparry, vuggy calcite, suggesting that this may be the type of calcite vein which forms under conditions resembling those encountered presently in VC-1. The analytical data are consistent with closed-system behavior of U and Th in the VC-1 calcite veins. copyright American Geophysical Union 1988

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 44918, 44919

44922 (NEDOJ—8703, pp 187-229) **Geothermal development promotion survey.** Masaki, Hiroyuki. (New Energy Development Organization, Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

The geothermal development promotion survey has been performed by the New Energy Development Organization since 1980 to provide essential data on the occurrence of geothermal resources and environments which are required for the development of geothermal power plants. The survey was started in 25 areas and has been completed in 15 of them. The survey consists of a geochemical survey, seismic survey, electromagnetic survey, electrical survey and rock drilling survey (to a depth of 500 - 1,800 m). High-temperature bands of above 200°C have been found in eastern Hachiman-daira, lower course of Dozan River, Kurino/Tearai, Tanburi, Yuzawa/Ogachi, Oku-Aizu, Shimokita, northern Azuma, Toyou, and western Unzen, while bands of below 200°C have been found in Okiura, western Teshikaga, areas around Lake Ikeda, Minamikayabe, and Yuda. To provide techniques for geothermal reservoir evaluation, a simulator development study was carried out in 1986 to improve and expand three-dimensional hydrothermal reservoir simulators and two-phase stream type three-dimensional reservoir simulators. Drilling of wells for observation, survey of the wells and overall analysis were carried out in the Kirishima and Sumikawa areas. (25 figs, 2 tabs)

44923 (NEDOJ—8703, pp 230-250) **Nationwide geothermal resources general survey. Second survey.** Tamao, Shiro. (New Energy Development Organization, Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceeding of parallel sessions for the 7th NEDO general assembly.

Four types of promising geothermal areas are selected based on results of the nationwide geothermal resources general survey (1st survey). Three types of volcanic hydrothermal convection areas include Niseko, Kokubu and Hakkoda while Minami-Aizu is selected as a potential high-temperature type area. The survey includes geothermal and geologic mapping, survey of distribution and ages of volcanic rocks, fluid geochemical survey, accurate gravity survey, resistivity survey, seismic P-wave velocity structure survey, heat yield survey, and analysis/evaluation. A heat source evaluation system is applied to the different survey results made in these four typical areas of different types to carry out the analysis of geothermal systems and evaluation of geothermal potential in each area. Other efforts include the examination of the various survey results, evaluation of their applicability, development of a conceptual model, estimation of the heat source size based on geological similarity, model for analyzing the heat flow rate, construction of a partition parameter model, and evaluation of the amount resources by a volumetric method. It is revealed that the geothermal potential is high in the Niseko and Hakkoda areas. (13 figs, 3 tabs)

44924 **(SAND—88-0820C) Drilling program for Long Valley Caldera.** Finger, J.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-880477—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012393/JAW.

From DOE geothermal program review; San Francisco, CA, USA (19 Apr 1988).

In September of this year, we will begin the first of four drilling phases in the Magma Energy Exploratory Well that is planned to reach a depth near 20,000 feet. This well will be used to verify the configuration of the magma body and to calibrate surface geophysical techniques against downhole data. It will also provide information of several kinds that is of interest to several groups: we will resolve geologic uncertainties—such as the location of fractured and abnormally pressured zones, chemistry of rocks and produced fluids, and magnitude of creep in the deep basement—that affect the drilling of any subsequent well, we will test drilling technology—e. g., high temperature drilling fluid, bits, coring, logging tools and tubulars—in a realistic environment, and we will gain insight on the history of collapse, resurgence, and intrusion in a major young caldera. 4 figs.

1505 Economic And Financial Aspects

44925 **(DOE/CE—0225) Opportunities for support of geothermal energy activities from Petroleum Violation Escrow funds.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Geothermal Technology Div.). Jun 1988. 24p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88013610/JAW.

The purpose of this document is to provide a reference for the geothermal community regarding the extent to which Petroleum Violation Escrow (PVE) funds might be employed by states to fund research, development, demonstration and applications pertaining to geothermal energy resources. The document highlights the background and status of the PVE funds being disbursed through state energy agencies and summarizes the types of energy-related activities being conducted with these funds and the process used to select and approve these activities. These funds provides a mechanism for expanding the contribution of geothermal technologies to domestic energy conservation and security.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 44920

44926 (NEDOJ—8703, pp 273-298) **Development of downhole pump.** Koizumi, Jun. (Ebara Corp., Fujisawa Works, Kanagawa, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This report deals with development of a downhole pump for pumping geothermal water. Special two-phase stainless steel is selected as material for members that come in contact with liquid, in consideration of resistance to heat, corrosion and wear by soil and sand. Highly refined mineral oil is chosen as lubricant because of its high resistance to heat. The shaft seal part and thrust are of a special design to ensure high heat resistance, sealing performance and load resistance. The canned motor used, which is of a sealing oil recirculation cooling type, is made of insulating material that can withstand high temperatures above the geothermal water temperature. Power cable material used and connecting and supporting members adopted for its are high in heat resistance, insulation performance, water resistance and reliability. A four-month in-plant trial operation of the No.1 test unit (motor drive: 50 ton/h at 170°C, total lift: 300 m, 70.5 kW), beginning in May 1986, was successfully completed. A 1,000-hour field test was carried out starting in January 1987 at Kokonoe-cho, Oita Prefecture, and its excellent performance was confirmed. A No.2 unit of 100 ton/h is currently under development.(22 figs, 6 tabs)

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 44918, 44920, 44926

44927 **(CRIE-W—87006) Simultaneous measurement of microscopic image and discharge pulses at the moment of electrical tree initiation in polyethylene.** Hozumi, Naohiro; Okamoto, Tatsuki; Fukagawa, Hiromasa. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 30p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753872/JAW.

In order to improve the insulation performance of CV cables, it is important to consider drastic measures by clarifying the mechanism of dielectric breakdown, but in spite of the situation that the initiation and growth of the alternating current electrical tree which originates from a protruded part of a semiconductor

layer, etc. is considered to be the important cause for dielectric breakdown, the phenomena at the instance of the initiation of the tree had remained unknown. Accordingly, a system to observe time-series wise and simultaneously microscopic images of the tree initiation and very small discharge pulses was developed in order to investigate the mechanism of the alternating current electrical tree initiation in polyethylene and using this system, an experiment of the tree initiation from a semiconductive needle electrode was conducted. As a result, the relationship between the initiation as well as the growth of the initial tree of less than around 10μm and the discharge pulse pattern which had so far almost been unknown could be grasped. By this system, it became possible to observe closely with an electron microscope the original tree initiation point by shutting down the implied voltage immediately after the initiation of the tree. (17 figs, 2 tabs, 14 refs)

44928 **(SGP-TR—115) Laboratory investigation of steam adsorption in geothermal reservoir rocks.** Luetkehans, J. (Stanford Univ., CA (USA). Stanford Geothermal Program). Mar 1988. Contract AS03-80SF11459;AS07-84ID12529. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88012261/JAW.

Some vapor-dominated geothermal reservoirs and low-permeability gas reservoirs exhibit anomalous behavior that may be caused by surface adsorption. For example, geothermal reservoirs in the Larderello are of Italy and reservoirs in the Geysers Geothermal Field, California produce little, if any, liquid. Yet to satisfy material balance constraints, another phase besides steam must be present. If steam adsorption occurring in significant amounts is not accounted for, the reserves will be grossly under-estimated. In addition, well tests may be misinterpreted because the pressure response is delayed owing to be adsorbed material leaving or entering the gaseous phase. In the present research the role of adsorption in geothermal reservoirs in investigated. Two sets of laboratory equipment were constructed to measure adsorption isotherms of cores from Berea sandstone, Larderello, and The Geysers. Seven experimental runs were completed using nitrogen on the low temperature apparatus at -196°C. Eight runs were conducted using steam on the high temperature apparatus at temperatures ranging from 150 C to 207°C. The largest specific surface area and the greatest nitrogen adsorption isotherm were measured on the Berea sandstone, followed by a core from Larderello and then The Geysers. Difficulties in determining whether a system had reached equilibrium at the end of each step lead to questions regarding the magnitude of adsorption measured by the steam runs. Nevertheless, adsorption was observed and the difficulties themselves were useful indicators of needed future research.

44929 **Prediction of thermal front breakthrough due to fluid reinjection in geothermal reservoirs.** Birdsell, S.A.; Robinson, B.A. (Mechanical Design Services, Los Alamos, NM (US)). pp 403-408 of Geothermal energy symposium. New York, NY; American Society of Mechanical Engineers (1988). (CONF-880104—).

From 11. annual energy-sources technology conference and exhibition; New Orleans, LA, USA (10 Jan 1988).

Chemically reactive tracers can be used to measure reservoir temperature distributions because of their extreme sensitivity to temperature. If a reactive tracer flows through a reservoir from an injection well to a production well, then early in the production history the tracer will contact mostly high temperatures and experience a high percentage of decomposition. As more energy is extracted from the reservoir, subsequent reactive tracer tests will show less decomposition. Tracers must be chosen which have reaction kinetics appropriate to the temperature patterns expected in the reservoir under consideration. If kinetics are too slow, no significant reaction occurs. If kinetics are too fast, essentially all of the tracer will react. In neither case can useful information be obtained. Seventeen chemically reactive tracers have been identified which are appropriate for geothermal reservoirs in the 70-275°C range. Of the 17 tracer reactions investigated, 5 are hydrolysis of esters, 3 are hydrolysis of amines, and 9 are hydrolysis of aryl halides. A method for choice of the appropriate reactive tracer for a given reservoir is also presented. The method requires measurement of the residence time distribution (from a conservative tracer test), an estimate of reservoir temperatures, and some simple geochemistry measurements and calculations. Several examples of choosing reactive tracers for existing geothermal reservoirs are given.

44930 **Future for geopressured-geothermal resources.** Ramsthaler, J.; Plum, M. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 145-152 of Geothermal energy symposium. New York, NY; American Society of Mechanical Engineers (1988). (CONF-880104—).

From 11. annual energy-sources technology conference and exhibition; New Orleans, LA, USA (10 Jan 1988).

The Hulin Well located in Louisiana represents a well having the potential to produce a commercial quantity of energy from a geopressured-geothermal reservoir. Using information from a geological analysis by the Louisiana Geological Survey, a log analysis by UTA, a recompletion strategy developed by Oil Technology Services (OTS), an automated fluid handling system designed by the Eaton Operating Company (EOC), and flow predictions by S-CUBED, EG and G Idaho has calculated the potential for a positive cash flow from this well. Commercial development depends on the evidence of positive cash flow and verification that the analytical tools used in the analysis properly predict well performance. The DOE Geopressured-Geothermal Program will operate the Hulin Well to add to the data base for predicting well performance and to assess the uncertainty in the analytical tools developed to date. This paper presents the basis for the positive cash flow predicted for the Hulin Well and summarizes the status of the technology supporting the prediction. Based on the assumption that the predicted reservoir flow and quality are correct, an additional analysis was conducted to estimate the price of gas at which commercial development would be feasible.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 44920, 44929, 44930

17 WIND ENERGY

REFER ALSO TO CITATION(S) 44545

1706 Wind Energy Engineering

44931 **(NAL-TR—945) Tower-wake/blade interaction noise of a wind turbine.** Nishiwaki, Hideo; Takeda, Katsumi. (National Aerospace Lab., Chofu, Tokyo (Japan)). Oct 1987. 9p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88753879/JAW.

An experiment is made of noise resulting from interaction between wake produced by the tower of a wind turbine and the blades rotating downstream. Noise from a wind turbine has a strong dipole nature. The sound pressure level is the greatest on the central axis of a blade and decreases very sharply with an increasing distance from the axis. The experiment is made on three towers with different cross sections, circular, ellipsoidal and square, and with the same geometrical moment of inertia. The towers with different sections are placed in different positions with respect to the direction of wind and a total of six cases are investigated. The investigation shows that the best acoustic characteristics related to tower wake is obtained when the ellipsoidal-section tower is placed with its major axis adjusted toward the wind direction. It is virtually impossible, however, to maintain the tower in such a position with respect to varying wind. Thus, the use of a tower with a circular cross section may be the most suitable from a practical point of view. A prediction of acoustic characteristics of an actual wind turbine should take into account the variations in the natural atmospheric stream and its Reynolds number (105), which may be ten or more times as large as that in this experiment. (7 figs, 1 tab, 1 ref)

44932 (NP—8770317) **Variable-speed wind power plant with an indirect rectifier and an optimum control system.** Ernst-Cathor, J. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 15 Dec 1986. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770317/JAW.

The author investigated the application of synchronous generators with indirect rectifiers as variable-speed power converters for wind power parks. He also presents a control method for variable-speed wind turbines which is to assure optimum performance in part-load operation. Reported are: Coil models, digital simulation, the experimental set-up, interferences in the intermediate circuit, stability problems of synchronous generators with uncontrolled rectifiers, electric moment control, and the reduction of network feedback of the inverter. Further subjects are: Extinction angle control, what to do in case of inverter flip, pulsed inverters with switch-off thyristors, performance. The aerodynamic and mechanical characteristics of a wind energy converter are gone into, as well as the options for optimizing the performance factor in the part-load region. Variable-speed rectifiers are found to reduce the load on the mechanical parts of the wind turbine. (HWJ).

44933 (PNL—6580) **The PNL single-tower measurement model of rotationally sampled turbulent wind, with user's guide for STRS2PC.** Connell, J.R.; Morris, V.R.; Powell, D.C.; Gower, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013166/JAW.

This report describes a single-tower rotationally sampled wind model, STRS-2, that approximates a set of time series of turbulent wind experienced by individual points rotating in circles in a crosswind plane using measurements from anemometers arrayed vertically along a single line. The purposes of the model are (1) to use turbulence measurements made economically from conventional single-tower arrays of anemometers, (2) to incorporate measures characteristics of the wind at specific sites under consideration for operation of wind turbines, spanning the height range if interest, and (3) to estimate the unmeasured turbulence characteristics in the crosswind plane that spans the disk of the rotor blades. 17 refs., 15 figs., 5 tabs.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 44606, 45001, 45040, 45111, 45124, 45127, 45128, 45223, 45295, 45344

44934 (CRIE-T—87014) **Estimation of application of new materials for thermal power plant. Investigation of application for valve and pipeline.** Tashiro, Hisao; Iwata, Uichi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 67p. (In Japanese). NTIS (US Sales Only), PC A04. Order Number DE88753861/JAW.

Systems, operation and problems at thermal power plants, and damages of valves at the time of periodic inspection were studied. Characteristics, manufacturing method, processing method and applications of variety of the latest materials were also investigated, and the items necessary for the evaluation of their application to plants were studied. Valves are manipulated frequently during the operation of thermal power plants. Especially, by-pass valves, drain valves, blowdown valves, minimum flow recirculation valves for feed-water pumps are subjected to severe conditions, and many reports have been received about the damages made to them. Items for the evaluation of new materials include errosion property, characteristics of materials, types of damages, etc. under various conditions. Study in comparison with the conventional stellite materials revealed that evaluation is necessary in accordance with conditions where they are applied. (16 figs, 39 tabs, 4 photos)

44935 (EPRI-AP—5829) **Cool water gasification: Combined-cycle power plant: Availability analysis: Final report.** Johnson, W. (Electric Power Research Inst., Palo Alto, CA (USA); Arinc Research Corp., Annapolis, MD (USA)). Jul 1988. 61p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88013113/JAW.

The Cool Water Coal Gasification Plant represents a jointly funded private industry program to design, build, and operate a 120-MW coal-based power plant to demonstrate new integrated gasification combined-cycle (IGCC) technology on a commercial scale. The UNIRAM availability assessment software program, developed by ARINC Research Corporation for the Electric Power Research Institute (EPRI), was used to assess the availability of the Cool Water Plant. Component reliability and maintainability measures were produced from plant performance records. ARINC Research investigated each of the most critical contributors to plant unavailability for any improvement in performance as a result of corrective measures implemented. Performance predictions were then established for the selected components and used in the UNIRAM model to predict future availability for the unit.

44936 (EPRI-CS—5754-Vol.1) **Guidelines for cofiring refuse-derived fuel in electric utility boilers: Volume 1, Executive summary: Final report.** Fiscus, D.E.; Wolfs, K.E.; Ege, H.D.; Kimber, A.; Joensen, A.W.; Savage, G.M. (Electric Power Research Inst., Palo Alto, CA (USA); Midwest Research Inst., Kansas City, MO (USA)). Jun 1988. 54p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88013640/JAW.

The quidelines address the procedures for evaluting proposed RDF (refuse-derived fuel) cofiring projects, RDF specifications and preparation, impact of RDF cofiring on power plant performance and operation, design criteria for RDF handling and other equipment, environmental control systems, capital and O and M cost estimates, economic analysis, and the breakeven RDF value to the utility. The economic analysis examples suggest that the value of RDF to the utility is only a fraction of the value of the fuel being replaced. This is because the incremental fuel savings derived from RDF cofiring are at least partially offset by the incremental capital and O and M costs. In order to maximize RDF value, it is important to select units for RDF cofiring that have at least 15 years of remaining life, operate at high capacity factor, are of sufficient size to consume the available RDF stream, and do not exihibit boiler slagging and fouling, electricstatic precipitator, or unit derating problems while burning coal or oil. 1 ref., 18 figs., 4 tabs.

44937 (EPRI-EL—5889-Vol.2) **Evaluation of software development tools: Volume 2, Appendixes: Final report.** Klein, S.A.; Beardmore, J.A. (Electric Power Research Inst., Palo Alto, CA (USA); ORI, Inc., Rockville, MD (USA)). Jun 1988. 241p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012902/JAW.

This report presents the results of an evaluation of software development and maintenance tools for power system planning and operations software. The objectives of this project were to determine the requirements for software tools that are not currently available, and to make recommendations on the appropriate role for EPRI in tool usage and future tool development. The study accomplishments included defining a set of requirements for software development tools, conducting a tool survey that identified tools potentially satisfying the requirements, developing an evaluation methodology that can be adapted by a utility for performing its own tool evaluations conducting a limited number of tool evaluations, and identifying potential EPRI roles and other desirable activities. The study found a large number of useful tools, many at low cost, but identified as a major unmet need its general goal of finding a reasonably small collection of tools that can comprehensively cover the priority requirements with maximum ease of use and minimum constraints placed on the using organization. This volume presents the following appendices: a glossary, the workshop details, the evaluation forms and individual tool test scenarios, a detailed listing of the tools identified in the survey, and a description of the test suite.

44938 (STEV—1987-R5) Electricity and heat production using natural gas. Hakkarainen, E.; Olsson, B.; Borchers, M. (Statens Energiverk, Stockholm (Sweden)). May 1987. 135p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88753723/JAW.

The purpose of this report is to describe technique, production costs and competitiveness for the production of electricity and heat from natural gas. The report deals with the production of electricity using gas turbines, conventional power plants fuelled with natural gas, combined cycle power plants which have both gas turbines and steam turbines, and combined power and heat (CHP) plants. In addition to the production of electricity and heat in combined power and heat plants, heat production with natural gas is also dealt with. The report commences with an international survey of electricity production based on natural gas, with the accent on Western Europe. It is concluded with a brief account of Swedish competence and skill in this field and of technical development. (authors).

44939 (STF—11A87062) Thermodynamic power production and heating. Lorentzen, G. (SINTEF, Trondheim (Norway)). Oct 1987. 14p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753734/JAW.

The report compares the thermodynamic efficiency of using a fuel for power production and heating. The comparison shows that power production is much more efficient than heating, but the increased thermodynamic efficiency of heating in dependent on the use of combined high temperature processes such as: Combined power/heat production; utilization of industrial waste heat; combined power production and heat pumps. The report discusses some technical aspects, and focuses on the use of heat pumps in particular. 11 drawings.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 44608, 45429, 45454, 45575, 45679, 45713, 45775, 45878, 45879

44940 (DTH-DCAMM—337) Secondary flows in negative corona precipitator. Larsen, P.S. (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik). Oct 1986. 38p. NTIS (US Sales Only), PC A03. Order Number DE88753688/JAW.

In a negative corona, barbed-wire, smooth-plate electrostatic precipitator the nonuniform field drives secondary flows of the ionized gas in the form of regular rolls of axial vorticity which are convected by the nearly uniform axial bulk velocity. The efffect of current density and electrode geometry on the developed roll strength is determined for the model problem of a periodic, unidirectional field. The analytical results are compared to velocity data obtained by in situ laser Doppler anemometry. The development length of rolls from the inlet is estimated from an approximate integral analysis. 11 refs.

44941 (EPA—600/7-87-028) Conceptual designs and cost esimtates for E-SO/sub x/ retrofits to coal-fired utility power plants:. Becker, D.F.; DuBard, J.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.; Gilbert/Commonwealth, Inc., Reading, PA (USA); Southern Research Inst., Birmingham, AL (USA)). Dec 1987. Contract AI01-79ET15264. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number TI88013518/JAW.

A conceptual design and cost estimate, based on information available at the beginning of 1987, was done for six cases of a retrofit of the E-SO/sub x/ process to a utility. The annualized cost in dollars per ton of SO_2 removed ranged from $301 to $378. The generic cost basis, used for other cost estimates, was used in this study and applied to a 500 MWe utility burning eastern medium sulfur (2.5%) bituminous coal. Capital costs compare very favorable with other retrofit SO_2 removal technologies. Sorbent or reagent cost is the largest single component of the costs.

44942 (EPRI/EA/EL—5612, pp 2.1-2.4) Automated PCB transformer flushing and solvent-recovery system. Ashley, K.C. (Quadrex HPS Inc., Gainesville, FL (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

An operating system is described for flushing (and soaking) the interiors of distribution transformers scheduled for disposal or servicing. The system has practical application in utility transformer and equipment repair centers and in similar contractor service operations. Mineral oil dielectric PCB concentrations can range from 499 ppm to 50 ppm or less. For dielectrics having 500-ppm PCB or more, or of the Askarel type, the system automates the 18-hour solvent-soak requirement. The flushing solvent is recovered for reuse by a PCB-separation process. In addition, salvageable transformer parts, i.e., bushings, and contaminated hand tools can be recovered in an optional decontamination-cleaning chamber. This chamber is a satellite unit as is supported by the main system. Major system features include recovery of the flushing solvent, minimum labor requirements for operation, and reduced worker exposure to PCBs and solvents. Reuse of the flushing solvent results in significant reduction of waste volume requiring disposal. 3 references.

44943 (EPRI/EA/EL—5612, pp 2.5) PCB residue in askarel and contaminated oil-filled transformers. Rouse, T.O.; Fessler, W.A.; Raymond, C.T.; Addis, G. (General Electric Co., Pittsfield, MA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This report discusses the results of measurements made to characterize the amounts and locations of PCB residues in transformers during and after disassembly. Several askarel transformers were drained, filled with trichlorotrifluoroethane (R113) for eighteen hours, drained again, and the core-coil assemblies were untanked. The clamps were removed, the core laminations were separated, and the coils were unwound. The materials in the various substructures were accumulated separately and the metallic and ceramic parts were separated from the cellulosic and other polymeric parts wherever possible. The weights of the various components were measured during disassembly and wipe samples for PCB analysis were taken from surfaces such as the tank wall after the R113 soak, the separated core laminations, and the unwound high - and low-voltage conductors. PCB contaminated oil-filled units were torn-down following this same procedure, but with two differences. Initial R113 soaks and the last cleanings of metallic parts were omitted. The weights and analytical results were used to reconstruct the distributions of PCBs in the various substructures as the tear-down progressed. These distributions are presented and the implications of these results to disposal and retrofilling of transformers containing PCBs are discussed.

44944 (EPRI/EA/EL—5612, pp 2.6-2.13) PCB-contaminated distribution transformer reclassification study. Frey, P.J. (Baltimore Gas and Electric Co., MD (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

In August, 1986, a study with the following objectives was begun: (1) Determine what effect, if any, the loading of transformers has in the process of removing PCB from the core and coil of a drained, flushed and refilled distribution transformer. (2) To determine the loading required to achieve the 50°C oil temperature specified in 40CFR761.30a.2.V. (3) To determine whether the use of temperature-sensitive labels on the tank is an adequate method to monitor oil temperatures. Results show that for (1) no significant changes in PCB levels regardless of transformer loading; (2) approximately 100% full loading required; and (3) use of temperature-sensitive labels proved adequate. 3 figures.

44945 (EPRI/EA/EL—5612, pp 2.14-2.15) **Continuous-column treatment of PCB contamination in mineral oil equipment.** Fox, R.D. (IT Corp., Knoxville, TN (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The continuous-treatment technology is based on an adaptation of potential and proprietary reagent formulations that use phase-transfer technology to destroy the PCBs. Phase-transfer components in the reagent facilitate transfer of the PCBs from mineral oil to the reagent where they can react and be destroyed. The continuous treatment of PCB-contaminated fluids is achieved by circulating the fluid through a cartridge containing the reagent in a solid form. The reaction by-products remain in the reagent phase. Use of the reagent in this mode enables simple equipment to be used. Treatment can either be done continuously or periodically to remove PCBs from individual transformers. Pilot-scale developmental testing of this technology was performed. Mineral oil containing 1800-ppm Aroclor was treated by circulating it through 1-kg bed of reagent for approximately 90 hours. At the end of the run the Aroclor 1260 concentration in the mineral oil was reduced to less than 10 ppm. Trichlorobenzene was also reduced to < 100 ppm.

44946 (EPRI/EA/EL—5612, pp 2.20-2.26) **Options available for askarel transformers.** Luby, T. (Sun Environmental, Inc., Canton, OH (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

PCB transformers containing askarel fluid are typically used for indoor substation applications for critical power distribution within a facility. With the current EPA regulations, managers are faced with deadlines by which decisions must be made to solve the PCB dilemma. This paper discusses the motivating factors facing the manager and the current solutions available to make the proper decision for the best method to be employed. The active solutions available would include the retrofill method to reclassify the PCB transformer to non-PCB status or the elimination of the PCB by a removal and replacement project. There are optional methods available for either approach, but cost effectiveness must be weighted against environmental concerns before a final decision can be reached that will satisfy EPA regulations.

44947 (EPRI/EA/EL—5612, pp 2.27-2.30) **Successful field procedures in the retrofill of European-designed transformers.** Clarke, H. (Grosvenor Transformer Services, Ltd., Yorkshire (England)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Successful retrofill of transformers and associated equipment requires a sound technical approach, safe and effective dielectric fluids, and a considerable amount of field planning and servicing resourcefulness. European-designed transformers, different in configuration from their US counterparts but broadly exported around the world, emphasize the importance of field-retrofill flexibility and ingenuity. The unique design of transformers in each country, such as conservator-type transformers, add to the need for very detailed field planning and execution. It is a mistake to generalize on field retrofills procedure without taking into account such differences by country. Field modifications to the transformer and equipment may be necessary and appropriate in conjunction with the retrofill itself. This paper describes and lists the lessons learned from the author's experiences in retrofilling hundreds of transformers in a number of European and international countries.

44948 (EPRI/EA/EL—5612, pp 2.31-2.40) **In-service reclassification of Askarel-filled transformers: program update.** McMahon, M.D.; Venable, T.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

EPA regulations restricting continued use of PCB transformers has caused most owners to seek the most-efficient and cost-effective means for minimizing PCB risk. PCB risk-reduction programs should include risk surveys, remedial action, and long-term plans for replacing or reconditioning PCB transformers. PCB transformer owners do have some choices in this program. PCB contaminated transformers may be retrofilled or replaced. Pure PCB (askarel) transformers have traditionally been replaced. The askarel is incinerated and the carcass is buried in a secure chemical waste landfill. Until recently, industry could not offer a means to clean an askarel transformer so that it could be reclassified to non-PCB status. Westinghouse offers a field-proven process by which pure askarel transformers may be reconditioned with guaranteed reclassification to non-PCB status of less than 50 PPM. Commercially owned transformers that have been reclassified at PCB levels as low as zero to 17 PPM following a few months of processing and ninety days of inservice waiting period required by EPA regulations 40 CFR 761 are discussed. 2 references, 2 figures, 2 tables.

44949 (EPRI/EA/EL—5612, pp 2.41-2.49) **System 50/ sup sm/ process for retrofilling and reclassification of Askarel transformers.** Massey, M.J.; Hopper, D.R. (REI Technologies, Inc., Concord, MA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This report is based on experience gained in the retrofilling and reclassification of approximately 40 PCB transformers using System 50/sup sm/ technology. Experience clearly demonstrates that PCB transformers can be cleaned and reclassified to a non-PCB status with a single interruption of transformer service of less than 24 hours and at costs fully competitive with transformer replacement. Cleaning is complete and permanent with essentially no intrusion into transformer operations. 5 figures, 1 table.

44950 (EPRI/EA/EL—5612, pp 2.50-2.56) **Problems associated with reclassified PCB transformer disposal.** McDermott, J.B.; Kump, R.K.; Coccio, C.L. (General Electric Corp., Schenectady, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The Fire Hazard Rule issued in July 1985 provided new restrictions on certain types and applications of transformers with the basic deadline for modification, removal, or reclassification in October 1990. Retrofill services as offered by various companies may be able to effect reclassification by the EPA definition, thus allowing the owner to continue operating the unit. The questions this should be answered are: how much PCB remains in the transformer after retrofilling, and what actions should be taken by the owner of a retrofilled transformer? The cradle-to-grave responsibilities of the original owner could require him or her to remedy any contamination resulting from the residual PCB in the retrofilled unit. A study was performed to determine which solvents were suitable for use as retrofill fluids. Diffusion studies and mathematical modeling were then performed for the most-likely retrofill solvents. Results of this investigation suggest that significant amounts of PCB remain in the internal structure of the transformer after reclassification to PCB-contaminated or non-PCB regardless of the retrofill process used. 5 references, 1 figure, 2 tables.

44951 (EPRI/EA/EL—5612, pp 2.57-2.59) **Retrofill in a remote location of network transformers using the Westinghouse system.** McPartland, J.P. (Iowa Electric Light and Power Co., Cedar Rapids (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The PCB transformers that are the subject of this paper present some special conditions. They are located in vaults beneath the sidewalks in downtown Cedar Rapids.

44952 (EPRI/EA/EL—5612, pp 2.60) **Experiences from retrofilling Askarel transformers: a two-year-service data program.** Atwood, G.R.; Martin, W.H. (Union Carbide Corp., Tarrytown, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Since RECLASS 50/sup SM/ Servicing was first offered in July of 1985, it has been accepted by more than 200 major clients. Over 3000 askarel servicings have been completed with no evidence of incompatibilities or other problems having been observed. In general, the vast majority of Askarel equipment has been found, upon examination, to be in excellent condition, dry, lightly loaded, and operating at oil temperatures of less than 50°C. The results of a Servicing Information Data Program are summarized. The data include most types of 15-KV equipment (including rectifiers, voltage regulators, and grounding transformers), over 23 different manufacturers and network and radical electrical configurations. A common question for existing transformers is the condition of the equipment and how much useful life remains. The mean age of equipment under service is greater than 25 years.

44953 (EPRI/EA/EL—5612, pp 2.61-2.62) **Environmental alternative to landfilling PCB transformers.** Myers, D.S. (S. D. Myers, Inc., Tallmadge, OH (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

In order to eliminate the lingering liabilities associated with the landfilling of PCB transformers, S. D. Myers, Inc. developed a process that will decontaminate the internal metallic parts of the unit. The cellulosic materials, along with the askarel fluid, will be incinerated. (For fluids contaminated up to 3300 ppm PCB, the PCBs will be chemically destroyed using the PCB-Gone Mobile Process.) The end product will be that the natural resources are recovered for reuse, the PCBs are destroyed, and no trace of the transformer will exist. The Myers disposal process, now in the midst of commercial scale-up, relieves the transformer owner of his PCB liability and eliminates the need for landfilling any transformer, PCB or not. The process involves, in the case of askarel units, first draining and flushing the unit to remove gross amounts of PCBs. After this, the transformer core and coils are untanked, all porous materials (paper, wood, gasket material) removed from the metal parts, the laminations separated and all the metal parts rinsed until the PCBs have been removed. This is done under EPA authorization, and health and safety issues have been addressed. The case is then separately rinsed both inside and out to ensure that the PCBs have been adequately removed.

44954 (EPRI/EA/EL—5612, pp 3.5-3.8) **PCB-related activities at EPRI, 1986-1987.** McLearn, M.E. Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Research activities concerning polychlorinated biphenyls (PCBs) are currently being conducted in three technical divisions of the Electric Power Research Institute. In the Electrical Systems Division, activities are focused on the decontamination of utility fluids, decontamination and destruction of PCB-containing capacitors and transformers, PCB fires, and substitutes for PCB. Projects in the Coal Combustion Systems Division address remedial action for PCB spills. Environment Division research is concerned with risk assessment for PCB exposure, risk management for utility PCB equipment and PCB-contaminated sites, and analytical methods development for polychlorinated dibenzodioxins (PCDDs) and dibenzofurans (PCDFs) in PCB matrices.

44955 (EPRI/EA/EL—5612, pp 3.9-3.13) **Transformer life expectancy.** Vick, S.C.; Tulloh, D.F. (Union Carbide Corp., Tarrytown, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper comprehensively analyzes transformer life expectancy. Conclusions are presented in terms of transformer type and dielectric fluid utilized. A rationale is provided in support of vigorous pursuit of policies by transformer owners that maintain existing transformers in service. 13 references.

44956 (EPRI/EA/EL—5612, pp 3.14-3.17) **Askarel transformer retrofill - an answer to common misconceptions.** Tulloh, D.F.; Vick, S.C. (Union Carbide Corp., Tarrytown, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

With the commercial introduction of technology to successfully retrofill transformers and reclassify them to non-PCB status, the transformer owner for the first time has a real choice of options for dealing with his or her PCB transformer problems. The choice should be made only after consideration of all the factors that might have a bearing, including risk reduction and management, near-term and long-term liabilities, transformer life expectancy, and safe operation. Although technology to successfully reclassify transformers to non-PCB status was introduced to the market in 1984 by UNISON Transformer Services, Inc., the safe use of silicone as a retrofill fluid has been demonstrated for many years. Even so, a number of questions concerning the advisability of utilizing silicone in askarel transformers have been posed. This paper enumerates and discusses these subjects in view of available scientific information.

44957 (EPRI/EA/EL—5612, pp 4.1-4.10) **Small-scale destruction of PCB fluids by electrical-discharge plasmas.** Tock, R.W.; Ethington, D. (Texas Tech Univ., Lubbock (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A process that uses high-voltage, ac discharges as a reaction zone to decompose oils was developed and patented. The system is unique in that the discharge plasma is confined to the interface between the oil being decomposed and water. The temperature of the discharge region is of sufficient magnitude to cause fast pyrolysis of the oil. Fluids contaminated with PCB's have been tested on a limited basis. Progress is being made in the removal of these PCB-containing fluids from active service. Incineration is an accepted technology. It is effective and can be regulated by governmental agencies. However, most incineration processes are large scale and necessitate that the hazardous fluid be transported to the disposal site; a process which also can have a high liability risk associated with it if an accidental spill occurs. The more preferable on-site technology for treating the PCB fluids has centered on both physical and chemical treatment processes. This paper describes a new technology being developed that may perhaps find a niche in the removal processes for PCB's on site. 9 references, 3 figures, 3 tables.

44958 (EPRI/EA/EL—5612, pp 4.15-4.18) **Arc pyrolysis project: a progress report.** Meyer, B.; Wittle, J.K.; Titus, C. (Arc Technologies Co., Oak Brook, IL (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A high-temperature DC arc furnace for the destruction of capacitors containing polychlorinated biphenyls (PCB) was permitted for test at the SCA Model City site of Chemical Waste Management. This prototype research and development furnace was developed with major funding by EPRI. The technology is based upon the utilization of a direct-current arc impinging on a molten-metal bath. The system is designed so that initial decomposition takes place in the molten bath and the resultant gaseous products are passed in the vicinity of the high-temperature arc. The system reduces PCBs to HCl, CO, H_2, and particulate carbon. Solids added to the system melt to produce the molten-metal bath in the furnace. Construction and permitting of the facility was completed in Sep-

tember of 1987. Testing of the system was to continue through November.

44959 (EPRI/EA/EL—5612, pp 5.19-5.22) **PCB management in a multi-plant Canadian Corporation.** Torossian, H. (Domtar Inc., Senneville, Quebec (Canada)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Domtar Inc., a Canadian Corporation, operates 75 plants in Canada and 25 in the US. It is a diversified company, producing pulp and paper products, packaging, construction materials, and chemicals. The Corporate Environmental Services Department established a program of PCB management to ensure compliance with Federal, Provincial, and State regulations, and to develop and implement a plan to reduce Domtar's exposure to PCB-related incidents. The objectives of this program are being achieved by the execution of the following phases: inventory of all electrical equipment containing or contaminated with PCB; technical audits and risk evaluation; analysis of options for action to reduce risks; and action plan and implementation. Options available for a company concerned with its PCB inventory are discussed.

44960 (EPRI/EA/EL—5612, pp 5.23-5.25) **Corrosion and its costly effects after the PCB fire.** Blackmon, K.; Wood, L.; Puma, M. (Blackmon-Mooring Steamatic Technologies, Inc., Fort Worth, TX (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The mechanical room of the Binghamton, NY State Office Building was the site of massive corrosion on all unpainted surfaces, a result of a PCB fire in 1981. All electrical switch gear, backup electrical generators, fire alarm systems, elevator switch gear, and massive amounts of electromechanical equipment will have to be replaced. Soot from the fire is laced with hydrogen chloride and chlorine, which combine with moisture to form HCl deposits. Emergency treatment and cleaning, beginning with rust stripping, is described briefly, emphasizing that protective gear must be used to protect the employees skin from the caustic effects of the cleaning chemicals.

44961 (EPRI/EA/EL—5612, pp 5.26-5.28) **PCB-contaminated transformer-oil-spill exposure assessment.** Brown, S.M.; Shields, W.J. (CH2M Hill, Bellevue, WA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A study was conducted to estimate potential human exposure levels associated with PCB-contaminated transformer oil spills following visible trace cleanup. This exposure assessment differed in two ways from those previously conducted by the EPA in support of their recent Toxic Substances Control Act (TSCA) PCB-spill-cleanup policy rule. First, PCB concentrations and associated exposure levels were estimated for conditions representative of visible trace cleanup at transformer oil sites. Second, the presence of mineral oil and its effect on the environmental behavior of PCB were considered. The EPA exposure assessments assumed conditions typical of disposal sites, rather than spill sites, and did not consider potential PCB-mineral oil interactions. PCB volatilization was found to be the most significant loss mechanism, and dermal contact is the most significant route of exposure. 8 references.

44962 (EPRI/EA/EL—5612, pp 6.1-6.5) **PCB Spill Cleanup Policy of 1987: summary and implications.** Shefchek, J.E. (Wisconsin Power and Light Co., Madison (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper summarizes and discusses the national PCB-spill-cleanup policy. The policy requires that all new PCB spills be cleaned up according to strict performance standards. All professionals responsible for PCB management should be familiar with this policy, since it once again changes the game rules for handling PCBs. This summary addresses and clarifies the PCB-policy's requirements for spill reporting, cleanup, post-cleanup sampling, and record-keeping, along with some of the policy's problems and implications. 4 references, 1 table.

44963 (EPRI/EA/EL—5612, pp 6.11-6.17) **Evaluation of decontamination of solid surfaces exposed to PCBs.** Bailey, A.; Kreps, K.; Hansen, W.G. (Ecochem, Inc., Seattle, WA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Based on the laboratory bench tests, designed to evaluate spills of low concentration (less than 500 ug/g) PCB contaminated-mineral oil, the following conclusions are made: (1) PCB-contaminated mineral oil preferentially spreads laterally across uncracked surfaces of concrete. Over a seven-day period with less than 2 g/100 cm^2 of mineral oil originally applied to a concrete surface, PCBs were found to have spread outside the 100-cm^2 test area outlined by caulking. (2) Wipe testing after the cleanup of concrete surfaces indicated that all cleaning agents tested were capable of cleaning the concrete test surfaces to the level of cleanup required for all categories under the TSCA PCB spill cleanup policy. However, mass balance determinations during the bench testing on concrete indicated that a minimum of 65% to 82% of the PCBs in the test area remained in the concrete after cleaning. (3) PCB-contaminated mineral oil absorbed strongly to asphalt, minimizing the spread of PCBs across the asphalt surface. (4) The strong absorption of PCBs to asphalt inhibited removal of PCBs by the cleanup procedures evaluated, and inhibited recovery of surficial PCBs during the wipe test procedure. Less than 10% of the PCBs were removed from the asphalt surfaces during the cleanup procedures. (5) No significant difference between the abilities of Penetone, TSP, or hexane to clean up PCB-contaminated painted or unpainted steel could be detected. 2 references, 1 figure, 2 tables.

44964 (EPRI/EA/EL—5612, pp 6.18-6.26) **Retrofill reduces liabilities resulting from a network transformer failure.** Hartley, M.L. (Knoxville Utilities Board, TN (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Knoxville Utilities Board's active PCB-removal program has indigenous side effects that have resulted in saving costs that otherwise may have been catastrophic. (1) Transformers that had, heretofore, un-noticed latent problems such as broken bushings, failing contacts, reduced BIL, etc. were discovered and repaired. (2) The initial removal of the Askarel, Inerteen, or other highly PCB-concentrated fluids immediately lowered the liability of a PCB fire or spill. (3) A transformer-evaluation program allowed the complete removal of certain underloaded transformers. With the retrofill program in full swing, a transformer failure in the high-voltage switch compartment resulted in a PCB spill of 21 gallons of Unison's TF-X fluid. There was a resultant brief explosion and expulsion of a smoke cloud. The now, 23,000-ppm fluid, produced no measurable PCB contamination external of the underground transformer vault from the smoke cloud. Clean-up was restricted to only the liquid itself that escaped the switch compartment. 5 references, 1 figure, 2 tables.

44965 (EPRI/EA/EL—5612, pp 6.27-6.30) **Clor-N-Oil test kit as a risk-management tool - an update.** Rhoads, K.W. (Utah Power & Light Co., Salt Lake City (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The Clor-N-Oil/sup TM/ PCB Screening Kit can be considered an effective risk-management tool only if the probability of a false negative is sufficiently small. Utah Power & Light Company

has used the Clor-N-Oil/sup TM/ Test Kit on over 12,750 transformers and has classified them as negatives or positives. A random sample of the Clor-N-Oil/sup TM/ negatives (those testing less than 50-ppm PCB) were tested by gas chromatograph (GC) methods to evaluate the probability of a false negative. Approximately 2% of those testing negative with the Clor-N-Oil/sup TM/ kit tested 50 ppm or greater by GC methods. Therefore, use of the Clor-N-Oil/sup TM/ kit as a screening tool to reduce the risk or probability of a PCB spill is effective. 1 figure.

44966 (EPRI/EA/EL—5612, pp 7.9-7.10) **Pyrolysis and combustion of PCB and TCB as contaminants in transformer fluids.** Eadon, G.; Narang, R.; Narang, A.; Swami, K. (New York State Dept. of Health, Albany (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

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Numerous laboratory simulations and real-world events have demonstrated the thermal conversion of neat or high concentration PCBs into the much more toxic PCDFs; the conversion of concentrated tri and tetrachlorinated benzenes (TCBs) into PCDDs and PCDFs is similarly well established. However, as PCB and Askarel-filled transformers are removed from service, the thermal behavior of transformer fluids containing PCBs and/or TCBs at 50-5000 ppm becomes of increasing interest. This paper describes the pyrolysis (by heating in an open tube at 550°C) and combustion (by injection into a natural-gas-fueled flame) of dilute Aroclor 1254 and TCB solutions in mineral oil, silicone oil, and tetrachloroethylene (TCE), and measurement of the resulting yields of PCDD and PCDF. In all experiments, dilution of PCB or TCB drastically decreased the mass of PCDF formed per gram of mixture. Alternatively, the yields expressed as mass of PCDF or PCDD per gram of chlorinated precursor exhibited modest but interesting variations with concentration providing some mechanistic insight into the formative and destructive processes underway.

44967 (EPRI/EA/EL—5612, pp 7.15-7.26) **Background concentrations of polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans in office buildings in Santa Fe, New Mexico.** Kominsky, J.R.; Slade, W.T.; Mooring, R. (National Institute for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

On June 17, 1985, a 500-kVA transformer located in the New Mexico State Highway Department General Office Building overheated and vented a vaporous-liquid aerosol containing polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). A study was conducted to determine how the reoccupancy criteria established for the building compared to normal concentrations of background contamination that exist in other similar buildings in Santa Fe. Three office buildings were tested for air and surface concentrations of PCBs, and PCDDs and PCDFs (tetra- through octachlorinated homologs and the respective 2,3,7,8-tetra isomers). Measurable air and surface concentrations of these contaminants were present in the buildings with all samples showing concentrations below the reoccupancy criteria. The data represent a baseline for these contaminants present in office buildings in Santa Fe, but may be indicative of those concentrations present in similar buildings in other geographical areas. 13 references, 3 figures, 3 tables.

44968 (EPRI/EA/EL—5612, pp 7.32-7.35) **Fires involving liquid and solid utility materials: a potential utility concern. II. PVC.** Sack, T.M. (Midwest Research Institute, Kansas City, MO (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The pyrolysis and combustion products of poly(vinyl chloride) (PVC) were studied by the use of on-line pyrolysis-GC/MS systems in order to investigate the potential role of PVC in the formation of toxic or otherwise harmful species during utility fires. PVC was thermally degraded alone and in the presence of ethylene-propylene rubber, rust, and steel and found to produce benzene, styrene, and other aromatic species in abundance under both air and inert atmospheres. The presence of oxygen is shown to facilitate the formation of chlorinated benzenes along with trace amounts of polychloronaphthalenes as a result of PVC degradation. Factors influencing the relative amounts of products included sample residence time in the heated zone, presence or absence of air, and presence or absence of metal species. 4 references, 1 table.

44969 (EPRI/EA/EL—5612, pp 7.43-7.47) **Production of PCDFs and related products from PCBs - an overview.** Erickson, M.D. (Argonne National Lab., IL (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—). Contract W-31-109-ENG-38.

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In the mid- to late-1970s, several workers demonstrated the formation of PCDFs from PCBs at elevated temperatures in the laboratory. This work went largely unnoticed by those concerned with the scientific, toxicity, regulatory, and product liability issues surrounding PCBs until February 1981 when a fire in a PCB-containing transformer in the Binghamton, New York State Office Building brought PCB fires to international attention. Since that event, numerous other PCB fires and related events have underscored the need to do something. That something has included new regulations from the US EPA and other legal restrictions in various countries, increased removal of PCB-containing electrical equipment from service, financial pressure from insurance companies, much better and faster cleanup and verification of the cleanup, and more research. 17 references, 1 table.

44970 (EPRI/EA/EL—5612, pp 8.1-8.3) **Preliminary analysis of risks associated with use of perchloroethylene in transformers.** Hirzy, J.W. (Environmental Protection Agency, Washington, DC (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

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There are acute and chronic toxicity concerns with the use of perchloroethylene (PCE) in transformers. Should a major leak or catastrophic failure of a PCE-filled unit occur, the relatively high vapor pressure of PCE could result in air concentrations high enough to present an acute risk of central nervous system (CNS), pulmonary, heart, liver, and kidney effects. CNS effects could become severe enough to make safe escape difficult or impossible and is thus the chief acute hazard/risk concern. Low-level leaks and exposure to workers conducting routine maintenance operations could present chronic risks of cancer as well as liver and kidney effects. Risks associated with combustion/pyrolysis products are hard to estimate, since only very limited information has been available on rates and levels of production of these materials. Hexachlorobenzene is of particular concern in this regard. 4 references.

44971 (EPRI/EA/EL—5612, pp 8.4-8.7) **Managing PCB risks in power plants.** Johnson, M.S.; Wilson, D.S.; Cohan, D. (Decision Focus Inc., Los Altos, CA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Should PCB transformers in power plants be replaced? Even if health risks are minimal, PCBs can present economic risks to utilities. An incident involving PCBs can result in millions of dollars in cleanup, replacement power, and legal costs. On the other hand, incidents are very unlikely, and replacing or retrofilling transformers can be very expensive. PCB equipment management decisions are difficult because incident occurrence, severity, and cost are all highly uncertain. The PCB Economic Risk Management Model (ASK), developed for EPRI by Decision Focus, helps utility personnel balance the certain costs of replacement or retrofilling against the uncertain costs of keeping PCB equipment in service. ASK has been used successfully by more than a dozen utilities

throughout the US to help manage PCB transformers. 3 figures, 1 table.

44972 (EPRI/EA/EL—5612, pp 8.8-8.11) **PCB risk assessment using the ASK model.** Sprouse, W.A. Jr. (Virginia Power Co., Richmond (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

PCB incidents (spills, fires, etc.) are rare, but the potential costs from an incident can be quite large. The likelihood, severity, and cost of an incident are highly uncertain. Consequently, the equipment management decisions facing electric utilities are challenging. A study of the risks posed by PCB equipment at Virginia Power's generating plants was performed using the PCB Economic Risk Management Model (ASK). Probability inputs to the model were obtained from the use of a risk-ranking worksheet. The results presented management with a life-cycle cost for each alternative course of action and allowed management to compare its own risk standards to a break-even probability. 2 figures.

44973 (EPRI/EA/EL—5612, pp 8.12-8.15) **Risk analysis of using PCB-filled transformers in industrial and residential applications.** Belmans, R.; Hesel, H.; Peytier, A.; Geysen, W. (K.U. Leuven (Belgium)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper describes the application of the Management Oversight and Risk Tree (MORT) method for the analysis of the hazards that may occur due to the use of PCB-filled transformers exposed to fire, as this may yield in specific circumstances the production of dioxins (PCDD) and furans (PCDF). The method reveals a number of measured that have to be taken in order to avoid the production of these extremely toxic products. 4 references, 2 figures.

44974 (EPRI/EA/EL—5612, pp 9.1-9.7) **GE's non-sodium process for chemically decontaminating mineral-oil dielectric fluid.** Horneck, C.W.; Coccio, C.L. (GE Industry Sales & Services, Schenectady, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

As early as 1979, scientists at GE's Corporate Research and Development Center, Schenectady, NY, recognized that PCB-contaminated transformer dielectric fluid could be chemically treated to reduce PCB content to non-detectable levels. This led GE to develop and patent a chemical decontamination process in 1981 using metallic sodium. Because of the potential difficulties in handling sodium (sodium and water produce hydrogen that can be explosive), GE embarked on a research program aimed at identifying a safe, economic means of reacting PCBs in transformer oil that would reduce PCB levels to below the US Environmental Protection Agency (EPA) 2 ppm upper limit for chemical destruction. To be successful, this process would be safe, efficient, and economical and would not require the use of sodium. This paper describes the successful development by GE of a patented non-sodium process meeting these objectives and design of a trailer-mounted PCB decontamination unit for commercial use utilizing the new advanced GE chemistry. 4 figures, 1 table.

44975 (EPRI/EA/EL—5612, pp 9.8-9.11) **Value of dehydration prior to retrofill of large PCB-containing transformers.** Velazquez, F.F. (Power Engineering Inc., San Juan (Puerto Rico)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Field-retrofill activities are highly desirable to reduce PCB contamination and to ensure prolonged transformer life. Particularly in larger transformers, an operating constraint (water build-up) that can limit or even curtail the success of retrofill must be eliminated prior to retrofill in order to ensure prolonged safety of transformer performance and life. A particularly well-established procedure involving the use of kerosene in conjunction with a well-designed vacuum-dehydration apparatus allows virtually complete and totally safe removal of water build-up. This paper details this method.

44976 (EPRI/EA/EL—5612, pp 9.12-9.17) **Commercial non-sodium treatment of PCB contaminated mineral oil.** Woodyard, J.P.; Exner, J. (International Technology Corp., Knoxville, TN (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper describes the current state of development of the first commercial KPEG technology for treating PCB's and other halogenated organic compounds. The process has been permitted for full-scale use in USEPA Region 2 and New York State, and was scheduled for a national TSCA mobile treatment permit demonstration in October. The process has also been used commercially to treat PCB and dioxin contamination in waste oils as part of several major Superfund projects, illustrating its versatility in handling waste contaminated with water, solids, and other contaminants not conducive to treatment by other available processes. The paper includes several case studies in which different waste materials have been treated successfully, and identifies plans for second- and third-generation technology designs for commercial deployment. The concept of joint IT/utility ownership of semipermanent facilities is described, including the status of several such projects in the US. 1 reference, 2 tables.

44977 (EPRI/EA/EL—5612, pp 9.18-9.24) **Georgia Power's solvent-extraction plant to remove PCBs from mineral oil.** May, P.F. (Veridyne, Inc., Topsfield, MA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

An EPRI project to evaluate PCB-removal processes and oil reusability led to concentrated effort being directed toward developing a solvent-extraction process. This was seen as a low-cost separation method for treating contaminated mineral oil as an alternative to the currently available destruction methods. Selecting diethylene glycol monomethyl ether as an ideal solvent, the theoretical predictions of high extraction efficiency were verified by pilot-plant testing. A full-scale commercial plant was then designed and constructed as a joint venture between EPRI and Georgia Power Company. Located at Georgia Power's Forest Park facility, this plant has demonstrated the ability to reduce the PCB concentration from as high as 330 ppm to less than 1 ppm. Operating costs are given for several applications of the solvent-extraction process. 1 figure, 1 table.

44978 (EPRI/EA/EL—5612, pp 10.1-10.4) **PCBA-102 update.** Burns, E.A. (S-CUBED, La Jolla, CA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The further development of the PCBA-102 for characterizing Aroclors in dielectric fluids and samples taken from spill sites is described. As a result of findings obtained on inter-utility studies managed by the Brown & Caldwell (RP-1263-23), several specific changes were incorporated into the operation of and training for the PCBA-102. The major changes incorporated were modifications of the software and implementation of several hardware upgrades. The instructions for use of the PCBA-102 were rewritten to provide additional clarity. PCBA-102 instruments were subjected to a series of environmental tests to assure they could operate in field-thermal and humidity environments and withstand vibrations that may occur in off-road transport of the instrument. Also presented are results of a detailed three-concentration level, four-Aroclor type, and five-instrument factorial study (in quintuplet) which

showed excellent repeatability. Results of interlaboratory testing among three utilities and a service laboratory are presented. Finally, in-house studies of testing and characterization of samples containing mixed Aroclor mixtures are presented. 4 references, 1 table.

44979 (EPRI/EA/EL—5612, pp 10.5-10.7) **Chromatography analysis of PCBs in transformer oils: a mini-round robin.** Addis, G.; Rouse, T. Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

An article appeared in Electric Light and Power magazine in December 1986 reporting that Capillary-Column Chromatography/Mass Spectroscopy (CC/MS) for analysis of PCBs in transformer oils was more accurate than Packed-Column Gas Chromatography/Electron-Capture Detector (PC/ECD) and Capillary-Column/Electron-Capture Detector (CC/ECD). It was said that these commonly-relied-upon ECD techniques had a tendency to give false high readings. It is shown in this paper that, when properly done, all three techniques give comparable results. This work was initiated by EPRI because a number of people and organizations expressed concern over the published claim of systematically incorrect PCB analyses.

44980 (EPRI/EA/EL—5612, pp 10.14-10.21) **PCB system inventory: to predict PCB contamination in electrical equipment.** Marquist, C.C. (Snohomish County Public Utility District, Everett, WA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Electric utilities often identify a system inventory as the preferred method to organize an oil-sampling program to test for PCB concentration. A full-scale inventory is implemented over a three- to four-month period (depending on the size of the service area, number of transformers, etc.) by a project manager, temporary supervisor, and data entry and field teams. The data provide current information to update utility maps and records (cards and computer information), billings for pole contacts, and maintenance requirements. Most importantly, the data provide a snapshot of geographic conditions that describe environmental and human health and safety exposure risks. The number of equipment in specific categories of exposure risk can be prioritized for a systematic program of sampling, testing, and removal, if warranted. The author discusses planning, implementation, costs, and benefits of data to other areas of system operation. 1 reference, 1 figure, 1 table.

44981 (NP—8770268) **Exhaust purification using bacterial suspensions (monocultures).** Kraemer, P. (Stuttgart Univ. (Germany, F.R.). Fakultaet 13 - Verfahrenstechnik). 30 Jun 1983. 148p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770268/JAW.

The reaction kinetics of propion aldehyde, croton aldehyde, and acrolein degradation by bacteria of the species Pseudomonas fluorescens was determined at 25/sup 0/C with a view to the biological separation of oderous and noxious substances from exhaust gases. A biological washing apparatus was constructed on the basis of the data, and experiments on mass transfer and on the identification of the reaction range were carried out. Under the experimental conditions, a 'slower reaction' took place besides absorption and diffusion. Mass transfer is limited primarily by this reaction. Using model calculations, a maximum Hatta number of 0.03 was calculated for cell concentrations of 0.5 g/l/sup -1/. The calculations also show that higher cell concentrations in the suspension may shift mass transfer at least into the transition region between reaction inhibition and diffusion inhibition. This means that in technical-scale bio-scrubbers mass transfer may be shifted towards the desired diffusion-controlled region. (RB)

44982 (PB—88-200191/XAB) **Calculation of two-dimensional, compressible, potential flow about symmetric erosion targets.** Fackrell, J.E. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). Nov 1987. 41p. (TPRD/M—1668/RR87). NTIS, PC E05/MF E05.

There is a need to predict the flow about wedge-shaped erosion targets placed in the exhaust stream of the Grimethorpe pressurized fluidized-bed combustion to assess local aerodynamic effects on the dust particles. This report describes developments to a cascade-flow prediction program so that it can deal with bluff target flows. The program was also used to predict the flow around previous erosion specimens used at Grimethorpe. A program was developed that can calculate incompressible, and compressible, subsonic flows about symmetric erosion targets. This ability was demonstrated for the current wedge-shaped targets at Grimethorpe and for previous erosion specimens. The compressible flow fields predicted by the program should be adequate for particle trajectory calculations.

44983 (PB—88-204276/XAB) **Advanced Utility Simulation Model, data-base maintenance (Version 1.0). Final report, October 1982-November 1984.** Stukel, J.J. (Illinois Univ., Urbana (USA). Coll. of Engineering). Apr 1988. 90p. NTIS, PC A05/MF A01.

See also PB—88-204268.

This report is one of 11 in a series describing the initial development of the Advanced Utility Simulation Model (AUSM) by the Universities Research Group on Energy (URGE) and its continued development by the Science Applications International Corporation (SAIC) research team. The AUSM is one of four stationary-source emission and control cost-forecasting models developed by EPA for the National Acid Precipitation Assessment Program (NAPAP). The AUSM projects air-pollution emissions (SO_2 and NOx), generating-technology types and costs of operation, and combinations of fuels and emission-control technologies to simultaneously meet electric demand and emission constraints on a least-cost basis for each year through 2010. Thirteen electric-demand regions are simulated, and output is provided for each of the 48 states.

44984 (PB—88-211750/XAB) **Initial test results of the limestone injection multistage burner (LIMB) demonstration project. Report for September 1984-April 1988.** Nolan, P.S.; Hendriks, R.V. (Babcock and Wilcox Co., Barberton, OH (USA)). May 1988. 16p. NTIS, PC A03/MF A01.

This paper discusses SO_2 removal efficiency and low-NOx burner performance obtained during short term tests, as well as the impact of LIMB ash on electrostatic precipitator (ESP) performance at Ohio Edison's Edgewater Station. Project goals are to demonstrate 50% or more SO_2 removal at a Ca/S molar stoichiometry of 2.0 and NOx emissions of less than 0.5 lb/million Btu while maintaining boiler operability and reliability. The tests, conducted before September 1987, indicated that 55-60% SO_2 removal and NOx emissions on the order of 0.48 lb/million Btu are achievable. The increased dust loading of a high-resistivity ash typically limited continuous operation to 2-6 hr. The paper discusses how the LIMB ash gave rise to back corona which, in turn, increased stack opacity to regulated levels. The extension of the project to include humidification of the flue gas is also described as a way to minimize these effects.

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44985 (AD-A—192502/3/XAB) **Mitigation of mains disturbances. Final report, April 1985-June 1986.** Sandler, R.B.; Canike, A.C. (Pennsylvania State Univ., University Park (USA). Davey Lab.). Nov 1987. 195p. NTIS, PC A09/MF A01.

This report discusses the use and performance of line conditioners and uninterruptible power supplies (UPSs). The devices studied are for use on single-phase, 120-V rms, 60-Hz service for maximum loads between 400 and 550 VA. Data are presented for both dynamic and static line and load regulation, turn-on and turn-off behavior, and response to four different high-voltage transient waveforms on the input. It is recommended that metal oxide varistors be connected upstream from any kind of line conditioner. The special problem of using line conditioners and UPSs with desktop computer systems are discussed.

44986 **(BHRA—88/04/XAB) Sellindge AC/DC converter Station: surge analysis.** Buttigieg, G.L.J.; Austin, K. (British Hydromechanics Research Association, Cranfield). Jan 1984. 20p. (RR—2137). NTIS PC$45.00.

The British Hydromechanics Research Association conducted a surge analysis of facilities at the Sellindge AC/DC Converter Station. The analysis was undertaken to determine suitable valve closure times in the event of an operator shutting a butterfly valve against the flow from two pump units following a false fire alarm. The total system includes a storage vessel, pumps, check valves, an accumulator, mains, butterfly and deluge valves, and sprinklers. Results of the analysis indicate that a five-second valve closure would result in an initial head rise well within the shut-valve pumping head. If it were necessary to achieve a faster valve closure, then three seconds would be the suggested minimum time. No operations problems should be encountered during normal valve opening and subsequent start-up.

44987 **(CRIE-T—86064) Design of total automatic power distribution system.** Miyauchi, Motomitsu; Inoue, Yukio; Yukihira, Kenji. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 25p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753858/JAW.

Improvement in efficiency and quality of power supply is very important for future power distribution system because it may become more complicated and diversified by the adoption of distributed type power supply system, promotion of setting cables underground, etc. A system structure based on optical information transmission system is proposed for the establishement of the total automatic distribution system in which advanced monitoring, control, protection and management functions for the distribution system are integreated. Features of the system and the network structure to meet the future requirements for feature expansion are described such as allocation of optimum function to each terminal station in the system, customer service, etc. A system structure with a high speed information optical fiber system as its nucleus is proposed for the total automatic distribution system. Functions of the business office, substation, and customer service terminals are summarized. Explanation was made also about the total network structure including all the terminals. (9 figs, 9 tabs, 3 refs)

44988 **(CRIE-T—87003) Detection of weak ultra-violet region light and its application for the Cerenkov radiation and partial discharge light under the normal facility lights.** Kurihara, Masayuki; Nakaoka, Akira. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 31p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753859/JAW.

For the maintenance, control and degradation diagnosis of power equipment, number of methods have been devised in which the light emitted from the equipment itself is to be detected. It is required to detect and image the point of emission in bright environment for the sake of efficiency and safety. Methods of detection and imaging of only the weak ultra-violet region light selected from the emitted wavelengths and of detection of partial discharge light under the normal facility light are described in this report. Visible light eliminating filters, filters which transmit ultra-violet light, and photoelectric element for ultra-violet light can be used as means to detect ultra-violet region light under visible light. The first two have drawbacks and the last one can be said as the best method among the three. Weak ultra-violet light can possibly be detected well if such a device is used. The device used for the observation had the detection power of 1,500 pC discharge under room lighting (eight 40W fluorescent lights) and 10,000 pC or more under the condition where daylight comes into the room through windows. (24 figs, 2 tabs, 24 refs)

44989 **(CRIE-W—86021) Allowable current of shallow underground cables.** Imajo, Naohisa; Kawahara, Kiyofumi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1987. 32p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753867/JAW.

The underground electric power distribution system has recently been implemented in urban areas, but since it requires its construction cost 10 to 15 times more expensive than that of the aerial distribution system, the reduction of the construction cost is important for implementing the underground distribution system smoothly. As a measure to realize a big cost reduction effect, the shallow burying technique of underground cables is being developed. This article reports the elucidation of the feared effect, which the sunshine provides the allowable current, through experiments and the calculation method of the temperature rise and allowable current of cables. The essential points of the article are as follows: When cables are 50cm or less from the surface of the ground, the cable temperature rises considerably due to the effect of the sunshine. For the soil basic temperature to be used for the calculation of the temperature rise of the shallowly buried cables, it is required to adopt the maximum summer value under the asphalted surface at the same depth of the top cable conduit. The allowable current of the shallow underground cables drops near the surface during the summer season and shows the trend to be the maximum at the depth of about 30cm. (26 figs, 2 tabs, 3 refs)

44990 **(CRIE-W—86026) Development of current limiting devices for distribution lines.** Okazaki, Masayuki; Inaba, Tsugunori. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Aug 1987. 43p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753868/JAW.

Since the underground installation of electric power distribution lines which has been carried out in urban areas costs more than the aerial installation of electric power distribution lines, it is considered as a part of the measures coping with the above situation to make electric power distribution devices and materials compact. However, the thermal as well as mechanical severities of distribution devices and materials as well as distribution lines are ruled by the load current and the short-circuit current of the lines. Accordingly, if the technique to control the short-circuit current is developed, it contributes to the miniaturization of the devices and materials, the low cost, and the prevention of repercussion of accidents, etc. Based on this understanding, a survey was made on current limiting devices which the currently available techniques were considered to be able to develop and such devices were manufactured experimentally for the examination of its feasibility. As a result, the location for installing the short-circuit current limiting device for electricity distribution was judged that the feeder exit was appropriate. In addition, after examining various current limiting systems, a high speed mechanical switch system and a bypass system were experimentally manufactured. Through cable fault tests, the crest value of the fault current could be limited to be 7kA or less under the condition that the specific short-circuit current was 12.5kA and the circuit voltage was 6.9kV when the fault detecting level was 2kA. (37 figs, 7 tabs, 4 refs)

44991 **(CRIE-W—86041) Develodment of small sized separable high voltage cable connector and flexible XLPE cable.** Imajyo, Naohisa; Okazaki, Masayuki; Hozumi, Naohiro; Kawahara, Kiyofumi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1987. 33p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753870/JAW.

As one of the measures to bring the construction cost of the underground electric power distribution system, which has recently been carried out in urban areas, a compact type of cable connector which was designed to be separable not like the conventional type and a flexible cable were developed. This article reports the measurement results of their performance and the examination results of the dimension and cost of the storage hand hole of the connector which was obtained from the viewpoint of cable-connecting workability. In other words, the separable elbow of the connector was made small in size without changing the performance of the connector. A flexible cable which modified the conductor and the shielding of the conventional CV cables was manufactured and even when it was bent by 5 times of the cable diameter, no deterioration of its structure and its shielding characteristics was shown. Furthermore, through the workability test of the combination of the above connector and flexible cable, it was evaluated that the considerable reduction of the working space was possible from the space used to be required and the cost could be cut in half in comparison with the conventional method. (17 figs, 16 tabs, 6 refs)

44992 **(CRIE-W—87001) Characteristics of 10-100mA vertical arcs in still air.** Inaba, Tsugunori; Matsuda, Shoji. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1987. 26p. (In Japanese). NTIS (US Sales Only), PC A03 . Order Number DE88753871/JAW.

With respect to disconnectors and air break switches, the arc extinction characteristics of very small current arcs at around the zero point of the-alternating current become a problem, but concerning plasma torches using the alternating current electric source, the duration characteristics of very small current arcs at around the zero point are deemed as a problem. As the basic characteristics in order to investigate the stability of the above alternating current arcs, the characteristics of very small current arcs of 10-100mA classes of the alternating current of 50Hz was analyzed and at the same time, the calculated values were compared with the values obtained through experiments. As the main conditions for arcs, it was set that arcs were to be still and vertical at 1 normal atmosphere of the air. Concerning the electric field-electric current characteristics of arcs, arc voltages showed the drooping characteristics and arcs persisted in a very stable way as the electric current increased. In the case of the constant electric current, arc voltages increased almost in a linear way against the length of the arc and the empirical formula concerning the voltage gradient and the arc current was obtained. (23 figs, 4 tabs, 9 refs)

44993 **(CRIE-W—87007) Improvement of the lamella structure in the interfacial region and of breakdown strength.** Okamoto, Tatsuki; Ishida, Masayoshi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Aug 1987. 31p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753873/JAW.

Disc specimens of 5 mm in thickness and 80 mm in diameter with various semiconducting materials as electrode materials were prepared for a.c. breakdown test. TEM photographs of the interfacinl region between the semiconducting layer and the insulation layer in the disc specimens were taken after its breakdown test in order to observe the lamella structure in the interfacial region. Lamella seems to start near a carbon particle of 30 - 100 nm in diameter and its direction is perpendicular to the surface of the carbon particle. Lamella structure neat the interface is affected clearly by the existence of semiconducting layer within 200 - 300 nm from the surface. The average lamella angle among lamella within 200 nm from the interface closely correlated to the 10% weibull breakdown strength. It is found that the smaller the angle decreases, the higher the breakdown increases. (34 figs, 10 refs)

44994 **(CRIE-W—87010) Approach to improve the breakdown strength by modifying carbon dispersion in semiconducting layer.** Okamoto, Tatsuki; Ishida, Masayoshi; Hozumi, Naohiro. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753874/JAW.

Eleven disc specimens with semiconducting electrode using various additives. A.C. breakdown voltage of these specimens was measured and the coagulated condition of carbon particles was analysed by means of TEM (Transmission Electron Microscope). It was found that carbon particles disperse (partly coarse and partly dense) in the semiconducting material. Coagulates of 100 - 200 mm size are connected with the chain of carbon particles. Xi zero, wavelength of damping oscillation wave-form of correlation coefficient A(Xi) of the color (dense and pale) of TEM photograph of semi-conducting layer material, corresponds with the size of the coagulated carbon particles. It was found, by the above experiments, that A.C. break-down strength could be improved by making the size of the coagulate of carbon particles up to 200 nm level. It was also found that the tree-generation model by the concentrated electric field and current was effective for the explanation of A.C. break-down strength. (30 figs, 1 tab, 9 refs)

44995 **(EFI-TR—3389) Economic gain in computer aided operation of distribution networks.** Finnset, T. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Dec 1986. 22p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753689/JAW.

A study is presented of the economic gain which can be expected by automatic operation of high-voltage distribution networks. The greatest gain is expected in automatic sectioning and activating of faultless networks, when faults have arisen. As basis for the evaluations/calculations, a system has been used with local measuring and control units, where all the control functions have been assembled in one place. 1 ref.

44996 (NEI-NO—44, pp 367-387) **Electrical distribution subsea - deep water test experience.** Haugland, H. (Veritec A/S, Bergen (Norway).). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

Several wet matable electrical connectors of different design and technology have been full scale tested in 300 metres water depth. This paper presents the learned experience from two test phases with respect to electrical distribution subsea. General findings and operational behaviours of cables, terminations and connectors are described. Five conductive type connectors and two inductive type connectors fabricated by 6 different connector manufacturers from USA, UK and France were tested. Each connector has been exposed to different sequences of operations and the primary field data has been the insulation resistance values of contacts/couplers both ref. to the environment and to other contacts/couplers. Cable/connector interfaces have been proven to be a "bottleneck" while subjected to pressurized seawater. Seawater may intrude areas intended to be dry if manual connectors are insufficiently connected or if solid cable terminations have been fabricated with insufficient quality assurance procedures. 9 drawings.

44997 **(NP—8770250) Optimizing municipal power distribution designs.** Rosenberger, R. (Universitaet der Bundeswehr, Hamburg (Germany, F.R.). Fachbereich Elektrotechnik). 29 Apr 1987. 131p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770250/JAW.

This paper presents the development of an algorithm for the computer-controlled design of cabled low- and medium-voltage distribution systems. After explaining the aims and intentions looked out for when planning cabled low-voltage distribution systems, the author discusses the basic features of the algorithm. Cabled medium-voltage systems and the methods applied are presented the same way. Examples facilitate access to the design algorithm used for planning purposes. A more elaborate algorithm determines the scheme for cabled low- and medium-voltage extensions. The paper concludes with a discussion of design algorithms for schemes for extension. (HAG)

44998 **(PB—88-865886/XAB) Lightning protection for domestic and commercial electrical power-transmission systems. January 1977-June 1988 (citations from the Engineering Index data base). Report for January 1977-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 152p. NTIS PC N01/MF N01.

Supersedes PB—87-859641.

This bibliography contains citations concerning design, materials, construction, and testing of various types of lightning protection for domestic and commercial electric-power systems. Topics include lightning arresters for electric-power-distribution systems, plants, transmission lines, and substations. Above- and below-ground electric-power-line protection systems are considered. Citations concerning telephone lines, exchanges, circuits, and systems are excluded. (This updated bibliography contains 310 citations, 28 of which are new entries to the previous edition.)

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REFER ALSO TO CITATION(S) 45030, 45533

44999 **(CERN-EP—87-217) The evolution of the Fastbus general purpose master (GPM).** Mueller, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 Dec 1987. 2p. (CONF-871006—53). NTIS (US Sales Only), PC A02. Order Number DE88013863/JAW.

From 34. nuclear science symposium and 19. nuclear power systems symposium; San Francisco, CA, USA (21 Oct 1987).

The numerous programmable Fastbus masters which are integrated into LEP data acquisition systems are mainly based on the Motorola 68 K microprocessor family. In a Fastbus system, the coupling between the microprocessor bus and the IEEE Fastbus can be solved in different ways: memory mapped, co-processor driven, or list driven. The GPM technique couples the 68 K data bus to Fastbus much like memory mapped I/O. A small set of addresses is provided to select all varieties of the Fastbus protocol. Since any operation in Fastbus can be written like a program, this technique was called 'general purpose'. The commercial, single width GPM module can directly execute 68 K instructions in Fastbus. It's master and slave posts handle 20 Mbytes/s data rates using a 128 kbyte data buffer which is mapped into the 68 K address space. New projects are building up on the GPM technique and its well established software environment. The CERN CHI interface and the DELPHI/LIP SGPM common project use a new standardized GPM programming model. Porting of the Los Alamos implementation of the IEEE Fastbus standard routines to this new model is under way.

45000 **(DOE/EIA—0473(87)) Nuclear power plant construction activity 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 9 Jun 1988. 50p. NTIS, PC A03/MF A01 - GPO; 1; GPO Dep. Order Number DE88011558/JAW.

This annual report published by the Energy Information Administration (EIA) presents data on nuclear power plant construction activity. The previous report, Nuclear Power Plant Construction Activity 1986, included data for units that, as of December 31, 1986, were (1) in the construction pipeline, (2) canceled, or (3) commercial operation as of December 31, 1986. The data in this report, which were collected on Form EIA-254, "Semiannual Report on Status of Reactor Construction," update the data in the previous report to be current as of December 31, 1987. Three types of information are included: plant characteristics and ownership; construction costs; and construction schedules and milestone dates.

45001 **(DOE/NE—0092) Technical reference book for the Energy Economic Data Base Program: EEDB Phase 9 (1987).** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jul 1988. Contract AC05-84OR21400. 435p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE88013034/JAW.

This document provides the current technical design bases for each technical data model (of and electric generating plant) in the eighth update. It contains a set of detailed system design descriptions (supplemented with engineering drawings) for the technical data models. This distribution is the latest in a series published since 1978. The overall program purpose is to provide periodically updated, detailed base construction cost estimates for large nuclear electric operating plants. These data, which are representative of current US powerplant construction cost experience, are a useful contribution to program planning by the Office of the Assistant Secretary for Nuclear Energy.

45002 **(DPST—88-566) PREP [Fault Tree Pre-processor]: A computer program to facilitate use of the SETS computer program for the Savannah River Reactor PRA.** Baker, W.H. (Savannah River Lab., Aiken, SC (USA)). 17 May 1988. Contract AC09-76SR00001. 101p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013354/JAW.

As part of the contract to provide technical support to the PRA for the Savannah River Reactors, Science Applications International Corporation [SAIC] has developed a computer program to facilitate the use of the SETS computer program in the solution of Fault Trees and Event Trees for the PRA. The PREP [Fault Tree Pre-processor] program is used to simplify user input for the SETS fault tree evaluation program. This includes a simple fault tree input format, linking of data and flag settings, error detection to assure that the SETS job will not abort due to incorrect input, and linking of many fault trees into many event tree sequences. The program is designed to run on a VAX computer operating with VMS. The created SETS input file can be transmitted to CRAY computer [currently at LANL] to run SETS. With simple modification, PREP can be adapted to run directly on a CRAY. It is anticipated that use of the PREP program by the Risk Analysis Group will identify the need for additional improvements. These improvements will be implemented as they are identified. In partial fulfillment of contract scope of work requirements, SAIC has submitted a manual for use of PREP and the program listing for PREP. These are included as attachments A and B respectively. Attachment B is included in selected copies only.

45003 **(NUREG—0020-Vol.12-No.6) Licensed operating reactors: Status summary report, data as of May 31, 1988.** Schwartz, I. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Jul 1988. 482p. NTIS, PC A21/MF A01 - GPO. Order Number TI88013577/JAW.

The US Nuclear Regulatory Commission's monthly LICENSED OPERATING REACTORS Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Information Resource Management from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. Since all of the data concerning operation of the units is provided by the utility operators less than two weeks after the end of the month, necessary corrections to published information are shown on the ERRATA page. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operation units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by the NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 45032, 45033, 45059, 45062, 45068, 45080, 45082

45004 **(EPRI-NP—5892) Chemical decontamination of BWR fuel and core materials: Examination of irradiated stainless steel specimens: Interim report.** Wang, M.T. (Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., San Jose, CA (USA)). Jun 1988. 40p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012898/JAW.

Dilute chemical decontaminations using AP-LOMI and Ap-CAN DECON solvent were performed on mill annealed, irradiated Type 304 stainless steel to evaluate its effect on surface corrosion and intergranular stress corrosion cracking (IGSCC). Constant extension rate tensile (CERT) specimens were fabricated from an irradiated tie rod of a La Crosse control blade. These specimens were then mounted on the fuel channel of a spent fuel bundle. These specimens and spent fuel bundles were decontaminated in the spent fuel pool at Quad Cities Nuclear Power Plant. The decontaminated CERT specimens were then returned to the GE Vallecitos Nuclear Center for evaluation. The specimen surfaces were examined following CERT SCC testing in a simulated BWR coolant environment. All the testing and examinations were remotely conducted in the hot cell. The surface examinations provided an assessment of chemical attack, particularly intergranular attack (IGA) during the decontamination processing. The CERT tests provided an assessment of any possible degradations of IGSCC resistance following decontaminating. Results of post-decontamination evaluation indicated that neither the AP-LOMI nor AP-CAN DECON processes led to any chemical attack or evidence of IGA. Irradiation assisted IGSCC was observed on all of the specimens tested in water with 8 ppm dissolved oxygen. However, the two dilute chemical decontaminations did not affect IGSCC susceptibility. 4 refs., 17 figs., 4 tabs.

45005 **(INIS-BR—1149) Aspects for selection of materials and fabrication processes for nuclear component manufacturing.** Pernstich, K. (Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro). 1980. 18p. (CONF-8011222—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703552/JAW.

From 1. Brazilian symposium on pipes and pressure vessels; Salvador, Brazil (19 Nov 1980).

For components of the Nuclear steam supply System of Light Water Reactors an extremely high safety standard is required. These requirements only can be met by adequate selection of materials and fabrication processes and their proper application in combination with strict quality assurance and control measurements. A general overview of the basic aspects to be considered in this connection is presented together with an indication of the present state of art for the main materials and fabrication processes.

45006 **(NUREG/CR—5075) The SAFT-UT [synthetic aperture focusing technique for ultrasonic testing] real-time inspection system: Operational principles and implementation.** Hall, T.E.; Reid, L.D.; Doctor, S.R. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 173p. (PNL—6413). NTIS, PC A08/MF A01 - GPO. Order Number TI88013713/JAW.

This document provides a technical description of the real-time imaging system developed for rapid flaw detection and characterization utilizing the synthetic aperture focusing technique for ultrasonic testing (SAFT-UT). The complete fieldable system has been designed to perform inservice inspection of light-water reactor components. Software was written on a DEC LSI 11/23 computer system to control data collection. The unprocessed data is transferred to a VAX 11/730 host computer to perform data processing and image display tasks. A parallel architecture peripheral to the host computer, referred to as the Real-Time SAFT Processor, rapidly performs the SAFT processing function. From the host's point of view, this device operates on the SAFT data in such a way that one may consider it to be a specialized or SAFT array processor. A guide to SAFT-UT theory and conventions is included, along with a detailed description of the operation of the software, how to install the software, and a detailed hardware description.

45007 **(SAND—88-0548C) Synopsis of the results of a test of a reinforced concrete containment.** Horschel, D.S. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 17p. (CONF-880616—4). NTIS, PC A03. Order Number DE88012415/JAW.

From 4. workshop on integrity of containments for nuclear power plants; Washington, DC, USA (15 Jun 1988).

Sandia National Laboratories completed the testing of a 1:6-scale containment building for a Light Water Reactor in July 1987. The containment building was made of reinforced concrete and had many of the features found in full-size containments. The test program consisted of a structural integrity test, and integrated leak rate test, and concluded with an over pressurization test of the structure. The subject paper will emphasize the overpressurization test of the containment model.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 45005, 45006, 45007, 45032, 45059, 45062, 45066, 45068, 45071, 45074, 45080, 45082, 45361, 45362

45008 **(EPRI-NP—5902) Nondestructive evaluation methods to measure inside diameters of steam generator tubing: Topical report.** Brown, S.; Krzywosz, K.; Cox, J.; Elmo, P.M. (Electric Power Research Inst., Palo Alto, CA (USA); Jones (J.A.) Applied Research Co., Charlotte, NC (USA)). Jul 1988. 23p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014500/JAW.

Numerous steam generators have experienced tube deformation or denting at support plate intersections due to localized mechanical forces exerted by a magnetite corrosion product within tube and carbon steel support plate annulus. In extreme cases, this denting has led to the early replacement of some steam generators, i.e., Surry and Turkey Point. In addition to monitoring the steam generator for tube wall degradation it has become apparent that it is also desirable to monitor the condition of dented tube-support plate intersections during scheduled inservice inspections. To this end, the acquisition of accurate and reliable information with regards to dent shape is important in establishing tube strain and identifying dent growth rates. This report summarizes the results of a round-robin evaluation conducted in 1983 using then available state-of-the-art technology for assessing dented tubes. More specifically, the capability of various systems for profiling and providing estimates of tube inner diameter on known dent shapes was demonstrated.

45009 **(IAE—4284/2) On experimental studying the dependence of reactor antineutrino energy spectra on nuclear fuel composition in a reactor core preliminaries.** Bogatov, S.A.; Borovoj, A.A.; Ketov, C.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702854/JAW.

For the first time the hypothesis that various fissible isotopes produce antineutrinos ν-tilde with energy spectra different one from another has been confirmed in neutrino experiment at the Rovno NPP. The hypothesis was suggested in 1975 and was generally accepted. It is taken into account during set-up and interpretation of results of neutrino experiments in reactors and lies in the base of the suggested method of remote determination of nuclear fuel isotope composition by means of spectral analysis of reactor neutrino radiation. 10 refs.; 3 figs.

45010 **(INIS-BR—1115) Finite element method with contact for tensile analysis in fuel rods.** Tanajura, C.A.S.; Galeao, A.C.N.R. (Laboratorio Nacional de Computacao Cientifica, Rio de Janeiro (Brazil)). 1987. 9p. (In Portuguese). (CONF-8709313—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703216/JAW.

From 10. national congress on applied and computational mathematics; Gramado, Brazil (21 Sep 1987).

Elements for mechanical analysis of fuel rod of a PWR type reactor, are presented. The rod, consists basically in a cylindrical coating of zircalloy which contains pilling of UO/sub 2/ pellets, is submitted to strong internal and external pressures, intense temperature gradients and neutron flux. These conditions lead several phenomena in the pellet (swelling, fracture, densification, creep) and in the cladding (embrittlement, corrosion, creep) which undergo deformations leading them to contact the restriction for the interpenetration is included in the problem without restriction by Lagrange multipliers. Considering a non-linear problem, due to the surface of contact to be not known a priori, the numerical solutions were obtained using the finite element method. (M.C.K.).

45011 **(INIS-BR—1142) Natural vibrations of a core banel of a PWR type reactor by elements of revolution shell.** Barcellos, C.S. de. (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Engenharia Mecanica). 1980. 19p. (In Portuguese). (CONF-8011222—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703242/JAW.

From 1. Brazilian symposium on pipes and pressure vessels; Salvador, Brazil (19 Nov 1980).

Aim to estimate the behavior of the cove barrel of PWR type reactors, submitted to several load conditions, their dynamic characteristic, were determined. In order to obtain the natural modes and frequencies of the core barrel, the CYLDYFE comprete code based in the finite element method, was developed. The obtained results are compared with results obtained by other programs such as SAP, ASKA and STRUDL/DYNAL and by other analytical methods. (M.C.K.).

45012 **(INIS-BR—1168) Utilization of Relap 5 computer code for analyzing thermohydraulic projects.** Silva Filho, E. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). (Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro). 1987. 3p. (CONF-871288—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703570/JAW.

From 9. Brazilian congress of mechanical engineering; Florianopolis, Brazil (7 Dec 1987).

This work deals with the design of a scaled test facility of a typical pressurized water reactor plant of the 1300 MW (electric) class. A station blackout has been choosen to investigate the thermohydraulic behaviour of the the test facility in comparison to the reactor plant. The computer code RELAPS/MOD1 has been utilized to simulate the blackout and to compare the test facility behaviour with the reactor plant one. The results demonstrate similar thermohydraulic behaviours of the two systems.

45013 **(INIS-mf—11237) Methods for reactor physics calculations of WWER-1000.** Apostolov, T.; Manolova, M.; Ivanov, K.; Petrova, T. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1986. 10p. (In Bulgarian). (CONF-8609439—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703261/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

The specific features of WWER-1000 reactor cores are summarized and considered from the viewpoint of reactor physics computations. A computer code package, developed at the Kurchatov Institute and a number of codes for steady state reactor calculations, available at the VMK computer program library at the Institute for Nuclear Energy, Sofia, are discussed.

45014 **(INIS-mf—11241) Low leakage refueling schemes for lowering the radiation damage of WWER-440 reactor veessels.** Andreev, P.B.; Jordanova, P.; Panevsky, I. (Energoproekt, Sofia (Bulgaria)). 1986. 5p. (In Russian). (CONF-8609439—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703263/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

In recent years, flux depression at the periphery of the reactor core for lower fluence through the reactor vessel is widely used. The paper reports on refueling methods and schemes, which permit both low-leakage and fuel cycle stretch-out operation of the WWER-440 reactor cores.

45015 **(NUREG/CR—5150) Steam generator operating experience: Update for 1984-1986.** Frank, L.; Stokley, J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Science Applications International Corp., McLean, VA (USA)). Jun 1988. 77p. (SAIC—87/3014). NTIS, PC A05/MF A01 - GPO. Order Number TI88012785/JAW.

This report summarizes operational events and degradation mechanisms affecting pressurized water reactor steam generator integrity, provides updated inspection results reported in 1984, 1985, and 1986, and highlights both prevalent problem areas and advances in improved equipment test practices, preventive measures, repair techniques, and replacement procedures. It describes equipment design features of the three major suppliers and discusses 68 plants in detail. Steam generator degradation mechanisms include intergranular stress corrosion cracking, primary water stress corrosion cracking, pitting, intergranular attack, and vibration wear that effects tube integrity and causes leakage. Plugging, sleeving heat treatment, peening, chemical cleaning, and steam generator replacements are described and regulatory instruments and inspection guidelines for nondestructive evaluations and girth weld cracking are discusses. The report concludes that although degradation mechanisms are generally understood, the elimination of unscheduled plant shutdowns and costly repairs resulting from leaking tubes has not been achieved. Highlights of steam generator research and unresolved safety issues are discussed. 21 refs., 8 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 44695, 44791, 44792, 44793

45016 **(Juel-Conf—61) HTGR fuel cycle. Proceedings of the status seminar covering the subject fields: HTGR fuel element development - HTGR graphite development - HTGR waste management.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Aug 1987. 195p. (In German). (CONF-8705304—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW.

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

In the spring of 1987, the HTGR fuel cycle project has been existing for ten years, and for this reason a status seminar has been held on May 12, 1987 in the Juelich Nuclear Research Center, that gathered the participants in this project for a discussion on the state of the art in HTGR fuel element development, graphite development, and waste management. The papers present an overview of work performed so far and an outlook on future tasks and goals, and on taking stock one can say that the project has been very successful so far: The HTGR fuel element now available meets highest requirements and forms the basis of today's HTGR safety philosophy; research work on graphite behaviour in a high-temperature reactor has led to complete knowledge of the temperature or neutron-induced effects, and with the concept of direct ultimate waste disposal, the waste management problem has found a feasible solution.

45017 (Juel-Conf—61, pp 3-24) **Ten years of research and development work for the HTGR fuel cycle - review of the first ten years of the HBK project.** Balthesen, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projekttraegerschaft Hochtemperaturreaktor). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

These ten years of R and D work in the project on HTGR fuel elements and graphites have been a very successful phase characterised by significant technological progress. Apart from the many other difficult problems that had to be solved, the necessary modifications of the reactor design concepts and of the fuel cycle strategy put a hard strain on the participants in the project. The results achieved now ensure that the novel, exacting safety concepts of future HTR plant which to a large extent rely on the fuel element quality, can be defined to be feasible. The graphite materials research work has made available well-proven graphites for the reflector region that will withstand the operational stresses during the whole reactor life, and the spent fuel management concept has taken shape in form of the direct ultimate disposal concept which, according to current know-how, seems to be a feasible and safe method. The work accomplished by the fuel cycle section of the project has laid the foundations for further progress towards introduction of the HTR system on the market, either by a national or by an international effort.

45018 (Juel-Conf—61, pp 27-46) **State of the art of HTR fuel element fabrication.** Heit, W.; Huschka, H. (Hochtemperatur-Reaktor-Brennelement G.m.b.H. (HOBEG), Hanau (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The ten years of fuel element development within the framework of the HBK project are characterized by three main stages, starting with the THTR fuel element, proceeding to the PNP/HHT fuel element containing highly enriched uranium, and for the time being ending with the low-enriched uranium fuel element for the THTR follower systems. As far as the chemical engineering problems are concerned, the fabrication processes have been developed almost to maturity, yielding high-quality fuel elements that meet the requirements. The technical components development currently has

reached the prototype scale, and further work will have to be done to lead developments to industrial scale.

45019 (Juel-Conf—61, pp 47-65) **Behaviour of HTR fuel elements under specified normal and under emergency conditions.** Pott, G.; Borchardt, G.; Nabielek, H.; Schenk, W.; Christ, A.; Mehner, A.W.; Ragoss, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.); Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.); Hochtemperatur-Reaktor-Brennelement G.m.b.H. (HOBEG), Hanau (Germany, F.R.); Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

Well-tested and fail-safe fuel elements are one of the preconditions of safe operation of an HTR-type reactor. While at first fuel elements with U/Th-BISO particles have been tested, the fuel elements developed for the advanced systems are spheres with a UO/sub 2/ kernel of 8-10% enrichment and a TRISO coating. Apart from this modified fuel concept and the TRISO coating development, another achievement is that the amount of free uranium in the fuel element could be reduced by more than a factor of 5-10, either by changes of fabrication processes, or of irradiation conditions. The tests made so far with these fuel elements showed fission gas release during irradiation (Kr 88) to be between 10/sup -/8 and 2-10/sup -7/, which can only be due to natural uranium contamination. Also, release of Cs 134/137 was very low (10/sup -5/), at irradiation temperatures of up to 12000/sup 0/C; at higher temperatures, release rates were increasing. Safety-related tests at, e.g., 16000/sup 0/C showed the good behaviour of UO/sub 2/-TRISO particles. These experiments were made with irradiated spheres in heating aparatus, at 1800/sup 0/C up to 2500/sup 0/C.

45020 (Juel-Conf—61, pp 67-89) **Graphite components for THTR follower reactors.** Theymann, W.; Mittenbuehler, A. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.); Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The graphite reflector of an HTR is a multilayer component. It is designed to serve as a supporting component and as the containment of the reactor core, and in addition has the function of gas flow control and neutron physical shielding. The external and internal layers therefore are different in design, with only the external wall serving as the supporting structure. The whole design of the reflector is determined by the specific properties of graphite, and by the irradiation effects on graphite.

45021 (Juel-Conf—61, pp 91-106) **Fabrication, testing, and qualification of reactor graphites.** Haag, G.; Maly, V.; Putsch, F.; Wilhelmi, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.); Sigri Elektrographit G.m.b.H., Meitingen (Germany, F.R.)). Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The work performed under the HBK project for development and testing of reactor graphites could have recourse to results and experience already gained in Great Britain, in the F.R.G., the USA, and the Netherlands. The specific problems to be tackled by the HBK project activities result from the particularly exacting requirements with regard to behaviour under irradiation that are to be met by the graphite reflector for the THTR follower plant. From a great number of candidate graphites, selected for testing and evaluation, the extensive irradiation experiments revealed a variety of graphites best suited to the various tasks in mind, as defined by the operational conditions. The tests examined radiation-induced changes of linear dimension, E-module, thermal expansion, and heat conductivity, as well as radiation-induced creep and corrosion in reactor graphites under specified normal and under accident conditions. The work performed also includes tests for defining design criteria for reactor graphite components. The goals have been achieved, but further work will be necessary, as new requirements are taking shape in the course of current THTR follower plant development.

45022 (Juel-Conf—61, pp 179-193) **Points of main interest of future activities in the field of HTR fuel cycle.** Kirch, N. Aug 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754176/JAW. (CONF-8705304—).

From Status seminar on the HTGR fuel cycle project; Juelich, F.R. Germany (12 May 1987).

The project goals for the years 1987 to 1993 have been set up, defined on the basis of the results achieved in the last ten years. The programme is mainly oriented towards the requirements of the HTR projects for electricity or process steam generation, and also takes into account the research policy framework. Fuel element testing is expected to complete the qualification of the currently developed fuel element with TRISO-coated particles and low enriched uranium. The interim storage technology is available. As for the ultimate disposal concept, testing and development work is carried out in the Gorleben mine together with project partners from industry.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 45033

45023 **(AECL—8775) On-line real time gamma analysis of primary coolant.** Kalechstein, W.; Kupca, S.; Lipsett, J.J.; Malm, H.L. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1985. 18p. (CONF-8504205—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703085/JAW.

From IAEA/NPPCI specialists meeting on new instrumentation of water cooled reactors; Dresden, German D.R. (23 Apr 1985).

The evolution of failed fuel monitoring at CANDU power stations is briefly summarized and the design of the latest system for failed fuel detection at a multi-unit power station is described. At each reactor, the system employs a germanium spectrometer combined with a novel spectrum analyzer that simultaneously accumulates the gamma-ray spectrum of the coolant and provides the control room with the concentration of radioisotope activity in the coolant for the gaseous fission products Xe-133, Xe-135, Kr-88 and I-131 in real time and with statistical precision independent of count rate. A gross gamma monitor is included to provide independent information on the level of radioactivity in the coolant and extend the measurement range at very high count rates. A central computer system archives spectra received from all four spectrum analyzers and provides both the activity concentrations and the release rates of specified isotopes. Compared with previous systems the current design offers improvements in that the activity concentrations are updated much more frequently, improved tools are provided for long term surveillance of the heat transport system and the monitor is more reliable and less costly.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 44815, 45083

45024 **(INIS-BR—1170) Energy-1: a computer code for thermohydraulic analysis of a LMBFR rod bundles, in a mixed convection regime.** Braz Filho, F.A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). (Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro). 1987. 4p. (CONF-871288—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703572/JAW.

From 9. Brazilian congress of mechanical engineering; Florianopolis, Brazil (7 Dec 1987).

A code was set up in which velocity, temperature and pressure distributions are calculated, using the porous body model, for a rod bundle where mixed convection regime plays an important role. Results show satisfactory agreement with experimental data, as well as a reduction in computational time when compared to ENERGY-III code.

45025 **(ND-R—1482-(R)) Review of the United Kingdom fast reactor programme: March 1987.** Bramman, J.I.; Wheeler, R.C. (eds.). (UKAEA Northern Research Labs., Risley). Mar 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753845/JAW.

The UK fast reactor programme is reviewed under the following headings: Progress with PFR; Reprocessing; Commercial Design Studies: Structural Integrity; Engineering and Components; Materials; Sodium Chemistry; Core and Fuel; Safety; Plant Performance Studies. (U.K.).

45026 **(WHC-SA—0095-FP) Fast Flux Test Facility performance monitoring management information: [Final report].** Newland, D.J. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 33p. (CONF-870917—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013585/JAW.

From ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation; Richland, WA, USA (13 Sep 1987).

The purpose of this report is to provide management with performance data on key performance indicators for the month of July, 1987. This report contains the results for key performance indicators divided into two categories of "overall" and "other". The "overall" performance indicators, when considered in the aggregate, provide one means of monitoring overall plant performance.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 45072, 45140, 45283

45027 **(GA-A—19115) TFE Verification Program: Semiannual report for the period ending September 30, 1987.** (General Atomics Co., San Diego, CA (USA)). Mar 1988. Contract AC03-86SF16298. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013619/JAW.

The objective of the semiannual progress report is to summarize the technical results obtained during the latest reporting period. The information presented herein will include evaluated test data, design evaluations, the results of analyses and the significance of results. The program objective is to demonstrate the technology readiness of a TFE suitable for use as the basic element in a thermionic reactor with electric power output in the 0.5 to 5.0 MW(e) range, and a full-power life of 7 years. The TFE Verification Program builds directly on the technology and data base developed in the 1960s and early 1970s in an AEC/NASA program, and in the SP-100 program conducted in 1983, 1984 and 1985. In the SP-100 program, the attractive features of thermionic power conversion technology were recognized, but concern was expressed over the lack of fast reactor irradiation data. The TFE Verification Program addresses this concern.

45028 **(LA-UR—88-755) Indirect solar loading of waste heat radiators.** Kirkpatrick, R.C.; Tabor, J.E.; Lindman, E.L.; Cooper, A.J. (Los Alamos National Lab., NM (USA); Mission Research Corp., Los Alamos, NM (USA); ARC, Monterey Park, CA (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880843—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007904/JAW.

From SPACE conference; Albuquerque, NM, USA (29 Aug 1988).

Waste heat from space based power systems must ultimately be radiated away into space. The local topology around the radiators must be considered from two stand-points: the scattering of sunlight onto the surfaces of the radiator and the heat load that the radiator may put on near-by components of the system. A view factor code (SNAP) developed at Los Alamos allows the computation of the steady-state radiation environment for complex 3-D geometries. An example of the code's utility is given. 4 refs., 2 figs., 1 tab.

2107 Regulation And Licensing

45029 **(EPRI-NP—5919) Nuclear plant in-service inspection requirements and practices in different countries: A comparative review:.** Mattu, R.K.; Anderson, W.R.; Connor, L. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., McLean, VA (USA)). Jul 1988. 200p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014202/JAW.

Countries with operating nuclear power plants have some basic standards, known as Regulations or Orders which require mandatory compliance. These standards require implementation through the use of inservice inspection (ISI) rules, criteria documents, supplementary guidance, etc. These rules are generally consensus documents prepared by knowledgeable and practicing specialists in the field of nuclear power plant examinations, testing, inspection, etc., of significant systems and components. This report provides a comparison of requirements and practices for inservice inspection of nuclear power plant systems and components in different countries. Comparisons made are based on responses received from selected countries (regulatory agencies and power plant operators) in the area of ISI regulation regarding non-destructive examination, testing and examination of major components, e.g., reactor vessel, steam generator, reactor coolant pump, recirculation pipe, feedwater piping, etc. Comparisons are made using ASME Section XI as the standard, since most countries use it as a mandatory requirement or as a basis for their guidelines for inservice inspection of their nuclear power plant.

45030 **(NUREG—0540-Vol.10-No.4) Title list of documents made publicly available, April 1-30, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Jun 1988. 350p. NTIS, PC A15/MF A01 - GPO. Order Number TI88012795/JAW.

This document is a monthly publication descriptions of the information received and generated by the U.S. Nuclear Regulatory commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used her, docketed does no refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

45031 **(NUREG/CR—2000-Vol.7-No.5) Licensee event report (LER) compilation for month of May 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA). Nuclear Safety Information Center). Jun 1988. 142p. (ORNL/NSIC—200). NTIS, PC A07/MF A01 - GPO. Order Number TI88012787/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations.

45032 **(NUREG/CR—2000-Vol.7-No.6) Licensee event report (LER) compilation: For month of June 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 125p. (ORNL/NSIC—200). NTIS, PC A06/MF A01 - GPO. Order Number TI88014089/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file

of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-1061, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 – Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System -- Description of Systems and Guidelines for Reappearing, provides supporting guidance and information on the revised LER rule.

45033 **(WHC-SA—0088) Power reactor decommissioning projects in the Federal Republic of Germany.** Miller, R.L. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-87RL10930. 6p. (CONF-8710111—48). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013579/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

During 1987, three power reactor decommissioning projects in the Federal Republic of Germany (FRG) were visited. The three projects were the Kernkraftwerk Lingen (KWL), the Kernforschungszentrum Karlsruhe Niederaichbach (KKN), and the Kerkraftwerk RWE-Bayernwerk Block A (KRBA). This paper briefly discusses the status of each of these projects and includes some observations on the FRG decommissioning methodology and philosophy.

2108 Economics

45034 **(INIS-BR—1155) Present market for nuclear energy.** Marzo, M.A.S. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1987. 13p. (CONF-8708270—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703558/JAW.

From Seminar Brazil and the international nuclear policy; Brasilia, Brazil (1 Aug 1987).

The present market for nuclear energy is present since nuclear production and electric power generation to the utilization of radioisotopes in medicine and biology. Some data about the main world suppliers to this market are shown. (E.G.).

45035 **(NUREG/CR—3899-Suppl.1) Utility financial stability and the availability of funds for decommissioning: An analysis of internal and external funding.** Siegel, J.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Jun 1988. 39p. NTIS, PC A03/MF A01 - GPO. Order Number TI88012897/JAW.

The NRC is currently developing final rules in the area of decommissioning nuclear facilities. A part of that rulemaking effort is assuring that funds will be available at the time of decommissioning of power reactors. This report provides an update by considering public comments received on the NRC's proposed rule on decommissioning (published February, 1985) and by analyzing the relative level of assurance of internal and external reserves. In its analysis, the report makes use of specific case utility financial situations. The report concludes that from a financial standpoint, with the exception of PSNH, internal reserves currently provide sufficient assurance of funds for decommissioning. The report also concludes that the NRC should recommend changes in bankruptcy laws, including decommissioning obligations in utility prospectuses, and conduct periodic financial reviews of nuclear utilities due to changing economic conditions.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 46009

45036 **(FEI—1689) Method of conjugate functions for the problems with nonuniform boundary conditions.** Yuferov, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1985. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702853/JAW.

Formulae of the perturbation theory explicity containing additive components conditioned with perturbation of edge conditions have been derived on the basis of the method of conjugate functions. Application of generalized functions for recording of differential operators in integral form convenient for construction of conjugate equations is described. Four known determinations of conjugate operator are compared and simple scheme for derivation of conjugate equations on the basis of integral representation of direct equations is obtained. The scheme suggested is compared with a classical one using as an example nonstationary diffusion equation. It is shown that the core of integral representation and the Green function of direct equation turn out to be possible to interpret in terms of importance function relative to neutron flux density phi. Hence it follows that the same functions determine importance distribution as to functionals of phi. 7 refs.

45037 **(Juel—2184) Neutronic calculations for the irradiation experiment TRIDEX in the vertical channel 2V3 of the research reactor FRJ-2 (DIDO).** Weise, L. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Feb 1988. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754175/JAW.

In the framework of the development of a fusion reactor blanket the irradiation experiment TRIDEX (Tritium Recovery Irradiation DIDO Experiment) takes place at the Juelich Research Reactor FRJ-2 (DIDO). The irradiations are considered in the reactor channel 6V1 of the D/sub 2/O-reflector and in the reactor channel 2V3 in a notch position at the core-edge. The topic of our neutronic calculations is the determination of intensity parameter values for the formation of tritium from lithium samples irradiated with neutrons on one hand and the determination of a reactivity equivalent value for the TRIDEX irradiation equipment on the other hand. The determination of the neutron spectrum needed for the neutronic calculations has been performed in a two-dimensional x-y-geometry. After recently achieved calculations for TRIDEX in the reactor channel 6V1 the analog computations in the reactor channel 2V3 have been accomplished. These calculations and their results are presented.

45038 **(UJV—8021-R) Initial value problem for the equations of reactor kinetics.** Kyncl, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Aug 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702957/JAW.

The initial value problem for the equations of reactor kinetics is solved while taking temperature feedback into account. The space where the problem is solved is chosen such as to correspond to the mathematical properties of cross-section models. The local solution is found by the iterative method, its uniqueness is proved and it is also shown that the existence of global solution is ensured in most cases. Finally, the problem of a weak solution is discussed. (author). 5 refs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 45069, 45075, 45076, 45077, 45078, 45079, 45348, 45512

45039 (CEGB-TPRD/B—0956/R87) On the calculation of leakage rates from vessels filled with high density gaseous CO/sub 2/ using pressure drop data. George, A.F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Sep 1987. 14p. (ARPWG/P—87-47). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754268/JAW.

This paper considers calculation methods to estimate leakage rates from pressure drop data from vessels filled with high pressure (40 bar) low temperature (25/sup 0/C) C)/sub 2/. It is essential to consider the non-ideality of CO/sub 2/ under these conditions if accurate results are to be obtained. There are two main areas where this is relevant: the first is the use of temperature measurements to adjust the measured pressure readings so that the effect of temperature fluctuations is eliminated. The second is in the conversion of the pressure drop data to volumetric leak rate. An example test is described in which it is shown that the CO/sub 2/ based temperature correction method improves the accuracy of the pressure drop estimate by about a factor of ten over using a perfect gas assumption and a factor of about 25 over not attempting to adjust the pressure at all. Also the flow rate obtained from assuming the gas was perfect was almost a factor of two too low. A method for scaling leakage rates to other temperature pressures and gases is also given brief consideration in this report. It is observed that the results of scaling are strongly dependent on the flow regime assumed and it is not possible to determine the flow regime from the pressure drop data. Consequently only upper and lower bounds to the scaled estimate can be quoted. (U.K.).

45040 (EPRI-CS—5857) Power plant pumps: Symposium proceedings. (Electric Power Research Inst., Palo Alto, CA (USA); Case Western Reserve Univ., Cleveland, OH (USA)). Jun 1988. 617p. (CONF-8703274—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012516/JAW.

From Symposium on power plant pumps; New Orleans, LA, USA (10 Mar 1987).

This EPRI sponsored Symposium on power plant pumps was held on March 10-12, 1987. Its major purpose was to bring together the appropriate electric utility engineers, manufactures and engineering consultants to interact constructively on the ever important topic of power plant pumps. Nineteen papers, reprinted in this proceedings, were presented at three half-day sessions, organized under the following topics: Utility experience and insights; New developments in pump design; Pump predictive maintenance and performance assessment. A fourth session was comprised of three tutorial lectures covering the following power plant pump trouble-shooting topics: Hydraulics and cavitation; vibration analysis; Expert systems. In addition, a concluding fifth session consisted of five concurrent discussion groups covering the following topics: Feedwater pumping systems; Vertical pumps; Monitoring, predictive maintenance and diagnostics; Pump hydraulics and cavitation; Trouble-shooting resources. Summaries of these discussion group sessions are given in this proceedings along with tabulated results of a symposium attended questionnaire, the list of attendees, the symposium agenda and the list of exhibitors. Twenty-eight papers have been cataloged separately.

45041 (EPRI-NP—5920) Cable indenter aging monitor. Shook, T.A.; Gardner, J.B. (Electric Power Research Inst., Palo Alto, CA (USA); Franklin Research Center, Norristown, PA (USA). Valley Forge Corporate Center). Jul 1988. 68p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014206/JAW.

This project was undertaken to develop a hand-held, nondestructive test device to assess the aged condition of electrical cable by in situ measurement of mechanical properties of polymeric jackets and insulations. The device is an indenter similar to those used to make hardness measurements. Comparison of measurements made on installed cables with previous measurements serving as baseline aging/mechanical property data will determine the state of aging of the field cables. Such a device will be valuable in nuclear and fossil plant life extension programs. Preliminary laboratory tests on cables covered with ethylene propylene rubber (EPR) and chlorosulfated polyethylene (CSPE) point to the measurement of the rate of force increase resulting from constant rate deformation as having the best correlation with progressive thermal aging. This first phase of the work has demonstrated the technical feasibility of the method. A second phase will include the generation of additional groundwork data and the design of the portable indenter for in situ plant measurements.

45042 (INIS-BR—1143) Projection and analysis of nuclear components. Heeschen, U. (NUCLEN, Rio de Janeiro (Brazil)). 1980. 22p. (CONF-8011222—). NTIS (US Sales Only), PC A03/MF Q01. Order Number DE88703243/JAW.

From 1. Brazilian symposium on pipes and pressure vessels; Salvador, Brazil (19 Nov 1980).

The classification and the types of analysis carried out in pipings for quality control and safety of nuclear power plants, are presented. The operation and emergency conditions with emphasis of possible simplifications of calculations are described. (author/M.C.K.).

45043 (INIS-BR—1144) General aspects of design and vessel nozzle analysis of nuclear power plants. Back, N. (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Engenharia Mecanica). 1980. 28p. (In Portuguese). (CONF-8011222—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703244/JAW.

From 1. Brazilian symposium on pipes and pressure vessels; Salvador, Brazil (19 Nov 1980).

Aspects of design and a procedure for nozzle tensile analysis under loads in project, normal and abnormal, emergency, failure and test conditions. For each condition, considerations about the tensile calculation methods, the tensile classification in corresponding categories and the comparison with admissible limits according to the norms. (M.C.K.).

45044 (RISO-M—2652) Development of a two-level modular simulation tool for dysim. Kofoed, J.E. (Risoe National Lab., Roskilde (Denmark)). Jul 1987. 266p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88754486/JAW.

A simulation tool to assist the user when constructing continuous simulation models is described. The simulation tool can be used for constructing simulation programmes that are executed with the rutime executive DYSIM86 which applied a modular approach. This approach makes it possible to split a model into several modules. The simulation tool introduces one more level of modularity. In this level a module is constructed from submodules taken from a library. A submodule consists of a submodel for a component in the complete model. The simulation tool consists of two precompilers working on the two different levels of modularity. The library is completely open to the user so that it is possible to extend it. This is done by a routine which is also part of the simulation tool. The simulation tool is demonstrated by simulating a part of a power plant and a part of a sugar factory. This illustrates that the precompilers can be used for simulating different types of process plants. 69 ill., 13 tabs., 41 refs.

45045 (SRD-R—441) Pipework failures - a review of historical incidents. Blything, K.W.; Parry, S.T. (UKAEA Safety and Reliability Directorate, Culcheth). Jan 1988. 34p. H.M. Stationery Office, London, price Pound 5.00.

A description is presented of the gathering of historical pipework incident data and its analysis to determine the causes and underlying reasons for failure. The following terms of reference were agreed: (a) To review data on failures associated with pipework to establish the principal causes of failure. This should include not only rupture of the pipe itself, but also pipework induced failures, such as severe flange leaks and excessive strains resulting in failure of connected equipment. (b) To suggest an incident classification for pipework systems which will alert design, construction, maintenance, and operating personnel to the need for special care. (c) To

advise non-piping specialists of the type of situation which could result in failure if not allowed for in the design, e.g. dynamic and transient conditions. (d) To recommend, possibly as the result of (a) above, areas where present procedures and codes of practice may require amplification. Brief descriptions are given of selected incidents where the consequences are considered to be serious in terms of damage and financial loss. For consequence analysis, the release rate is an important parameter and, where possible, the proportion of incidents in the failure mode categories, leaks, "ruptures/severances" are given. Although not one of the agreed objectives, the determination of failure rates was recognised as an important requirement in the risk assessment of pipework systems. The quality of data gathered however was found to be inadequate for any statistical analysis and no failure rate values are given in this report.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 45053

45046 (INIS-BR—1171) Considerations about the utilization of electrically heated rods used for simulation of nuclear fuel pins. Lima, R.deC.F. de; Carajilescov, P. (Pernambuco Univ., Recife (Brazil); Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). (Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro). 1987. 4p. (CONF-871288—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703573/JAW.

From 9. Brazilian congress of mechanical engineering; Florianopolis, Brazil (7 Dec 1987).

The dinamic behavior of electrically heated rods used for simulation of nuclear fuel pins in nuclear power transients, is analysed by the application of the lumped parameter and the finite difference methods. Deviations of the rods surface conditions, for extreme accidental transient conditions are presented and discussed.

45047 (NUREG/CR—5095-Vol.1) Thermodynamic nonequilibrium in post-Critical-Heat-Flux boiling in a rod bundle: Description of experiments and sample results. Tuzla, K.; Unal, C.; Badr, O.; Neti, S.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Jun 1988. 151p. NTIS, PC A08/MF A01 - GPO. Order Number TI88012781/JAW.

This report describes the post Critical-Heat-Flux heat transfer experiments in a 3 x 3 rod bundle conducted at Lehigh University during the period of measurements of thermodynamic nonequilibrium in the post-CHF regime and to characterize its effects on the two-phase heat transfer. The data from these experiments are to be used for verification and improvement of post-CHF heat transfer models used in thermal-hydraulic codes. As part of this project a two-phase loop which incorporated special features and instrumentation necessary for post-CHF tests was constructed. The nine rod test bundle incorporated a heated shroud to simulate the operating characteristics of a large rod bundle. A special "hot patch" technique was developed and used successfully for the first time to achieve steady-state post-CHF conditions in a rod bundle. Special steam temperature probes, developed earlier at Lehigh for tests in single tubes, were modified for use in the rod bundle. Each test provided measurements of system of system pressure, coolant flow rate, wall heat flux, wall temperatures, two-phase equilibrium qualities, and vapor superheat temperatures. These primary data permitted determination of wall heat transfer coefficients, nonequilibrium vapor qualities, and when applicable, quench front propagation velocities. 35 refs., 68 figs., 16 tabs.

45048 (NUREG/CR—5095-Vol.2) Thermodynamic nonequilibrium in post-Critical-Heat-Flux boiling in a rod bundle: Data for stabilized quench front tests. Tuzla, K.; Unal, C.; Badr, O.; Neti, S.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Jun 1988. 206p. NTIS, PC A10/MF A01 - GPO. Order Number TI88012782/JAW.

Included in Volume 2 is a tabulation of the 97 sets of data obtained from 88 stabilized quench front experiments. Stabilized quench front experiments were performed under steady-state post-CHF conditions throughout the test section. Typical wall temperatures of the center rod as a function of time are shown. The temperatures for the run are stable for the recorded duration of the run (170 seconds). There were at least a few minutes of unrecorded time preceding this period for the stabilization of the conditions in the test section. A plot of wall and vapor temperature histories at the two vapor probe elevations is given. The rate of change in wall temperature is less than 0.2{degree}C/sec. Histories of the hot-rod temperatures which are stable and well above the saturation temperature are provided. Under these stabilized conditions, data at any time could represent the run. Generally, the data at a time close to the middle of the total duration of the run was selected to represent the run.

45049 (NUREG/CR—5095-Vol.3) Thermodynamic nonequilibrium in post-critical-heat-flux boiling in a rod bundle: Data for advancing quench front tests. Tuzla, K.; Unal, C.; Badr, O.; Neti, S.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Jun 1988. 563p. NTIS, PC A24/MF A01 - GPO. Order Number TI88012783/JAW.

This report describes the post-CHF (critical-heat-flow) heat transfer experiments in a 3 {times} 3 rod bundle conducted at Lehigh University during the period of 1982-1986. The objective of these experiments was to obtain measurements of thermodynamic nonequilibrium in the post-CHF regime and to characterize its effects on two-phase heat transfer. The data from these experiments are to be used for verification and improvement of post-CHF heat transfer models used in thermal-hydraulic codes. As part of this project a two-phase loop which incorporated special features and instrumentation necessary for post-CHF tests was constructed. The nine rod test bundle incorporated a heated shroud to simulate the operating characteristics of a large rod bundle. A special "hot patch" technique was developed and used successfully for the first time to achieve steady-state post-CHF conditions in a rod bundle. Special steam temperature probes, developed earlier at Lehigh for tests in single tubes, were modified for use in the rod bundle. Each test provided measurements of system pressure, coolant flow rate, wall heat flux, wall temperatures, two-phase equilibrium qualities, and vapor superheat temperatures. These primary data permitted determination of wall heat transfer coefficients, nonequilibrium vapor qualities, and when applicable, quench front propagation velocities.

45050 Application of texture in predicting nuclear fuel cladding creep. Daugherty, W.L.; Murty, K.L. (North Carolina State Univ., Nuclear Engineering Dept., P.O. Box 7909, Raleigh, NC (US)). *Nuclear Technology;* **80**: No. 3, 443-450(Mar 1988).

X-ray diffraction techniques have been used to measure the texture of Zircaloy-4, which is described quantitatively by the crystallite orientation distribution function (CODF). Procedures for evaluating the anisotropy parameters in the modified Hill equation (R and P) from the CODF and their use in predicting creep behavior are reviewed. Alternatively, the same anisotropy parameters can be obtained from creep test data using appropriate mechanical deformation concepts. These R and P parameters are used to predict the creep behavior of fuel rod cladding both out of pile and in pile. The procedures involved in obtaining the anisotropy parameters from either crystallographic texture data or creep data are summarized. These two approaches, previously discussed separately in the literature, are brought together for a direct comparison. Predictions of creep behavior based on texture measurements are compared with creep data. The utility of the anisotropy parameters in predicting postirradiation cladding dimensions is illustrated by reviewing the work of another research group. Excellent agreement between their model predictions and experimental results of postirradiation examination is observed.

45051 **A noninvasive technique for the evaluation of diversion cross flow at the inlet of a simulated fuel rod bundle.** Sedaghat, A.; Castellana, F.S.; Hsu, R.H.; Macduff, R.B. (Columbia Univ., Dept. of Applied Physics and Nuclear Engineering, New York, NY (US)). *Nuclear Technology;* 80: No. 3, 360-370(Mar 1988).

Diversion cross flow was characterized from a two-subchannel simulation of a nuclear fuel assembly using a gamma camera. The gamma camera alllowed external monitoring over the length of the test assembly, thereby eliminating experimental problems associated with flow partitioning and an isokinetic withdrawal system, allowing the possibility of noninvasive measurement. The experiment was performed by providing fixed but different flow rates to each subchannel. The higher mass flow rate stream was traced with a gamma-emitting radionuclide, /sup 99m/Tc pertechnetate. Activity in each subchannel was measured by the camera. Diversion length was found to be relatively small and strongly dependent on gap spacing. Effective lateral velocity through the gap was also evaluated. With some exceptions, the results were in good agreement with the predictions of the subchannel analysis computer code COBRA IIIC. At a high inlet axial mass velocity ratio of 4, however, the agreement with the prediction was poor.

2204 Control Systems

REFER ALSO TO CITATION(S) 45051

45052 **(INIS-mf—11239) Experience in using analog reactivity meters at the Kozloduj NPP.** Kashchiev, G. (Kombinat Atomna Energetika, Kozloduj (Bulgaria)). 1986. 6p. (CONF-8609439—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703582/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

Analog reactivity meters of the PIR family, developed at the Kurchatov Institute, have been used during the start up of the Kozloduj WWER-440 reactors. A PIR-2M has been routinely used for the start up of Units 1 through 4, includung start up after refueling for Units 3 and 4. The experience in using these devices indicates that they provide for a reliable estimation of the actual physical and kinetic characteristics of the WWER-440 reactors.

45053 **(NUREG/CR—5095-Vol.4) Thermodynamic nonequilibrium in post-critical-heat-flux boiling in a rod bundle: Data for retreating quench front tests.** Tuzla, K.; Unal, C.; Badr, O.; Neti, S.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Jun 1988. 195p. NTIS, PC A09/MF A01 - GPO. Order Number TI88012786/JAW.

During this retreating quench front experiments, there was only one dependent parameter, the wall heat flux. Experiments were carried out at six different heat fluxes between 0.76 and 2.57 W/cm^2. Experiments at each heat flux provided approximately 15 data points which are tabulated in this report with consecutive serial numbers. The first experiments in each of these six groups of data contain an additional figure which plots the propagation history of the DO point into the test section. 1 ref.

45054 **(WHC-SA—0004) CRAW: An expert system for nuclear reactor cover gas alarm analysis.** Zimmerman, B.D.; Rawlins, J.A. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1987. Contract AC06-87RL10930. 8p. (CONF-870832—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013662/JAW.

From Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry; Snowbird, UT, USA (31 Aug 1987).

CRAW is an expert system designed to distinguish fuel pin rupture at the Fast Flux Test Facility. The software is used to evaluate tag gases detected by the alarm system and access operational consequences of a rupture. The ability to distinguish fuel rod as opposed to fuel pin rupture is included. The software is implemented on an IBM-PC. (DWL)

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 44807, 44812, 45080, 45884, 45885, 45886

45055 **(AERE-R—11733) Studies of environmental radioactivity in Cumbria, Part 12. Modelling of the sea-to-land transfer of radionuclides and an assessment of the radiological consequences. Final report.** Howorth, J.M. (UKAEA Harwell Lab. Environmental and Medical Science Div.; Department of the Environment, London (UK)). Dec 1987. 140p. (DOE-RW—88.006). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88753839/JAW.

A mathematical model is described which represents the sea-to-land transfer of actinides discharged into the Irish Sea from the Sellafield reprocessing plant. The model successfully reproduces the marine distribution of plutonium and americium in the Irish Sea between Cumbria and the Isle of Man and evaluates the magnitude of the transfer process to land. The radiological consequences of this transfer are calculated for the years 1954 to 2000 taking into account actual and future predicted discharges. The contribution from nuclear weapon tests and from Sellafield's atmospheric discharges are also evaluated and compared. The calculated annual dose from sea-to-land transfer to the average person living in Seascale reached a maximum of 24 microSieverts in 1973 and declined subsequently to 4 microSieverts by 1985 compared with the recommended ICRP principal limit for the general public of 1000 microSieverts. Corresponding figures for a hypothetical critical group are 35 microSieverts in 1973 and 20 microSieverts in 1985. The dose has decreased less steeply since 1973 than the corresponding decrease in discharges from Sellafield over the same period reflecting recycling of actinides accumulated in sea-bed deposits. Dose calculations for use of the beach at Seascale are also included.

45056 **(CEA-DAS—453) Reference earthquakes determination. Regulations for nuclear installations.** Levret, A.; Mohammadioun B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 12p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754199/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

Regulations in effect in France for taking into account the seismic motion at a site to ensure the safety of nuclear installations is based upon a seismotectonic approach of deterministic nature. This approach is implemented by a vast number of observations compiled for the most part, in two banks of reliable and uniform data. The first of these contains macroseismic data over about a 1000-year period in France and neighbouring countries the second is made up of strong ground motion recorded in seismic regions the world over. During the first step of an analysis, a maximum reference earthquake is defined for the site, which, by drawing upon a statistical treatment of the strong motion data bank is subsequently matched up with a response spectrum that is representative of both the site intensity and the characteristics of the reference earthquake.

45057 **(CEA-DAS—454) Provence earthquake 11 June 1909. Macro seismic observations.** Levret, A.; Goula, X. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 10p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754200/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

Since 1975 in order to be in conformity with the requirements of the French nuclear program, a review of historical seismicity was undertaken in France. The assessment of seismic hazard for the safety of nuclear plants is in fact based upon a seismotectonic approach which needs to take into account the macroseismic data of the reference earthquake. The discovery of an unpublished document (SPIESS 1914) containing a very detailed description of the effects of the 11th june 1909 Provence earthquake at 809 points in the epicentral area (geological and topographical characteristics, description of the buildings and the damage incurred, as well as the description of each seismic shock felt and the direction of ground

motion), has made it possible, among other things, to draw up an isoseismal map and to correlate local variations in intensity with the geological and topographical features.

45058 **(CEA-DAS—455) French network and acquired experience on record strong ground motion.** Ferrieux, H.; Mohammadioun, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 8p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754201/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

The network intended to record strong ground motion in continental France is composed for the most part of instrument packages incorporated into nuclear installations, which are supplemented by a certain number of accelerometers placed in the most highly seismic areas. In a country where the level of seismicity is relatively modest, such a network is not conductive to the acquisition of new data, which, instead, is obtained through spot studies of limited duration using more sensitive instruments or through the recording of strong ground motion in neighbouring countries.

45059 **(EPRI-NP—5900) Feasibility of full-system LWR [light water reactor] decontamination: Final report.** LeSurf, J.E. (Electric Power Research Inst., Palo Alto, CA (USA); LN Technologies Corp., Columbia, SC (USA)). Jul 1988. 167p. Research Reports Center, Box 50490 Palo Alto, CA 94303. Order Number TI88014499/JAW.

Chemical decontamination of the complete BWR or PWR coolant system is now technically and financially feasible for major outage work. Potential advantages of decontaminating the full coolant system rather than a subsystem include lower residual radiation fields, reduced outage time, and lower recontamination rates. This study developed a method for assessing the site-specific technical feasibility and cost savings for full-system decontamination.

45060 (INIS-BR—1147-Vol.3, pp 21-29) **Monitoring of radioactive liquid effluents generated by IPEN/CNEN- General aspects and optimization of existing control methods.** Seki, C.R.; Mazzilli, B. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The main objective of the liquid effluents monitoring at the IPEN's facilities is to guarantee that the amount of radioactivity released into the environment is in accordance with the Basic Standards of Radiation Protection. Although the control of the liquid effluents has been done in a routine basis since the beginning of the operation of all the radioactive installations available, the expansion of several departments, as well as the construction of new units of reserach and production, asks for optimized control methods of release. It was therefore, developed a study looking for a more dynamic time sharing utilization of the radiation detection system at the Division of Environment Monitoring of IPEN. The main task of this study is to optimize the counting time of the radionuclides generated as liquid effluents at the IPEN's facilities. Data are presented for /sup 24/Na, /sup 51/Cr, /sup 60/Co, /sup 123m/Te, /sup 124/Sb, /sup 137/I and /sup 137/Cs.

45061 **(INIS-mf—11242) Utilization of low-temperature fluids: thermal pollution, technical solutions and economic aspects.** Penchev, P. (Energoproekt, Sofia (Bulgaria)). 1986. 13p. (In Bulgarian). (CONF-8609439—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703264/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

The thermal potential of low-temperature waste liquids, gases and air from industrial and energy producing installations is estimated. The ecological impact of nuclear power plants, using cooling water from the Danube river, is considered. Recommended technical solutions, based on the worldwide experience and the specific conditions, are considered and their economic effectiveness is analyzed.

45062 **(SAND—88-1596C) The efficient calculation of chemical interactions in the primary circuit of LWR's [light water reactors] during severe accidents.** Wheatley, C.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-8806143—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013023/JAW.

From 2. nuclear reactor severe accident chemistry symposium; Toronto, Canada (5 Jun 1988).

Interactions between fission products, structural, control rod and clad materials, steam, fuel and neutron poisons can give rise to hundreds of different chemical species in the primary circuit of an LWR during the course of a severe accident. Such interactions affect fission product transport within the primary circuit in a variety of important ways. Consequently, they must be treated if fission product release in particular is to be at all realistically predicted. We will first summarize a model for treating these interactions and state the form of the equations that govern the chemical reactions in the model. We discuss the difficulties with solving the equations using standard methods in the context of our application and devote the body of the paper to a description of an efficient method we have developed for their solution. We show that the equations can be recast into nearly linear form through the identification of a complete set of dominant independent species. We will describe our solution method based on this and give illustrative results which show it to be computationally efficient and reliable.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 45026, 45037, 45054, 45083

45063 **(INIS-GB—147) [Scottish Universities Research and Reactor Centre]. Annual report 1986-1987.** Whitley, J.E. (comps.). (Scottish Universities Research and Reactor Centre, Glasgow (UK)). 1988. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754142/JAW.

The paper presents the Scottish Universities Research and Reactor Centre Annual Report 1986-7. The contents contain the Director's Report, Reactor and Associated activities, and research activities. The reactor studies are described with respect to the reactor operations, isotope production and computing. The research work includes: environmental radioactivity, neutron activation analysis, particle track analysis, body composition studies, isotope traces in biology, nuclear physics, thermoluminescence dosimetry, gamma-ray irradiation processing, radiation effects on electrical insulation, isotopic geology, and NERC Radiocarbon Laboratory. (U.K.).

2207 Plutonium And Isotope Production Reactors

45064 **(INIS-BR—1169) Heat removal by natural convection in a RPR reactor.** Sampaio, P.A.B. de. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). (Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro). 1987. 4p. (CONF-871288—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703571/JAW.

From 9. Brazilian congress of mechanical engineering; Florianopolis, Brazil (7 Dec 1987).

In this paper natural convection in RPR reactor is analysed. The effect of natural convection valves size on cladding temperature is studied. The reactor channel heat transfer problem is solved using finite elements in a two-dimensional analysis. Results show that two valves with PHI = 0.16 m are suited to keep coolant and cladding temperatures below 73/sup 0/C.

45065 **(PNL—6522) FERRET-SAND II physics-dosimetry analysis for N Reactor Pressure Tubes 2954, 3053 and 1165 using a WIMS calculated input spectrum.** McElroy, W.N.; Kellogg, L.S.; Matsumoto, W.Y.; Morgan, W.C.; Suski, A.E. (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013160/JAW.

This report is in response to a request from Westinghouse Hanford Company (WHC) that the PNL National Dosimetry

Center (NDC) perform physics-dosimetry analyses (E > MeV) for N Reactor Pressure Tubes 2954 and 3053. As a result of these analyses, and recommendations for additional studies, two physics-dosimetry re-evaluations for Pressure Tube 1165 were also accomplished. The primary objective of Pacific Northwest Laboratories' (PNL) National Dosimetry Center (NDC) physics-dosimetry work for N Reactor was to provide FERRET-SAND II physics-dosimetry results to assist in the assessment of neutron radiation-induced changes in the physical and mechanical properties of N Reactor pressure tubes. 15 refs., 6 figs., 5 tabs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 45007, 45026, 45062, 45723, 46207

45066 **(BNL-NUREG—41320) Analysis of risk reduction methods for interfacing system LOCAs [loss-of-coolant accidents] at PWRs.** Bozoki, G.; Kohut, P.; Fitzpatrick, R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. (CONF-880601—38). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012518/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

The Reactor Safety Study (WASH-1400) predicted that Interfacing System Loss-of-Coolant Accidents (ISL) events were significant contributors to risk even though they were calculated to be relatively low frequency events. However, there are substantial uncertainties involved in determining the probability and consequences of the ISL sequences. For example, the assumed valve failure modes, common cause contributions and the location of the break/leak are all uncertain and can significantly influence the predicted risk from ISL events. In order to provide more realistic estimates for the core damage frequencies (CDFs) and a reduction in the magnitude of the uncertainties, a reexamination of ISL scenarios at PWRs has been performed by Brookhaven National Laboratory. The objective of this study was to investigate the vulnerability of pressurized water reactor designs to ISLs and identify any improvements that could significantly reduce the frequency/risk of these events.

45067 **(EPRI/EA/EL—5612, pp 5.1-5.4) PCB transformer fires: the risk in nuclear power plants.** Blackmon, K. (Blackmon-Mooring Steamatic Technologies, Inc., Fort Worth, TX (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

It is estimated that 1/2 of the present nuclear power plants operate with PCB-filled transformer equipment. In an attempt to obtain better estimates of clean-up costs in a nuclear power plant under reasonable-loss scenarios, a study was commissioned. This study was a joint venture between Blackmon-Mooring Steamatic Technologies, Inc., (BMS-TECH) and M & M Protection Consultants. This joint study was conducted at a typical pressurized-water reactor plant consisting of two 1000-MW units. Three specific scenarios were selected and analyzed for this typical power plant. These scenarios were: (1) an electrical failure of a transformer in an isolated switch gear room; (2) a transformer exposed to a 55-gallon transient combustion oil fire in the auxiliary building; and (3) a PCB transformer involved in a major turbine lube fire in the turbine building. Based on results of this study, the insurance carriers for this industry implemented an adjustment in their rate structures for nuclear power plants that have PCB equipment.

45068 **(EPRI-NP—4498-Vol.8) The Reactor Analysis Support Package (RASP): Volume 8, LWR [light water reactor] set-point analysis guidelines: Final report.** Betancourt, J.M. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1988. 541p. Unlimited audience, publicly available. Research Reports Center, Box 50490 Palo Alto, CA 94303. Order Number TI88014200/JAW.

This report documents the Reactor Analysis Support Package (RASP) light water reactor (LWR) setpoint analysis guidelines. The information presented is applicable to utilities with either pressurized water reactors (PWRs) or boiling water reactors (BWRs) who plan to assume primary responsibility for performing safety analysis and setpoint determination. The report describes a generic process for establishing appropriate and justifiable limits for the reactor monitoring and protection systems setpoints. In doing so, the report addresses the LWR setpoint methodology bases; the determination of model inputs, operating envelope limits, analytical setpoints, and limiting events; the sources of uncertainties; and the application guidelines for setpoint determination. Guidelines are also provided for generating, if applicable, the power distributions needed for safety analysis and setpoint determination. Additionally, the report addresses margin recovery options which can be undertaken if the event acceptance limits are not met. Specifically, guidelines are provided for using a statistical treatment of uncertainties in lieu of the generally used deterministic approach. Finally, the application of the setpoint methodology, including the statistical combination of uncertainties (SCUs), is presented for a PWR loss of flow event. The guidelines are applicable to analog, digital, and hybrid monitoring and protection systems.

45069 **(EPRI-NP—5930) A criterion for determining exceedance of the operating basis earthquake: Final report.** Reed, J.W.; Anderson, N.; Chokshi, N.C.; Kennedy, R.P.; Metevia, W.J.; Ostrom, D.K.; Stevenson, J.D. (Electric Power Research Inst., Palo Alto, CA (USA); Benjamin (J.R.) and Associates, Inc., Mountain View, CA (USA)). Jul 1988. 321p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88013634/JAW.

A criterion is recommended for determining whether the Operating Basis Earthquake (OBE) has been exceeded after the occurrence of a seismic event at a nuclear power plant. The technical procedure provides a fast and effective means for assessing the damage potential of any "felt" earthquake in the first few hours after occurrence. For OBE exceedance to occur, the recommended criterion requires exceedance of both a response spectrum parameter and a second damage parameter, referred to as the Cumulative Absolute Velocity (CAV). The detailed operational requirements for implementing the criterion are provided. The criterion was developed, based on a study of earthquake damage to conventional buildings, review of past damage to power plants and heavy industrial facilities, blast damage, fragility data and equipment vibration performance, to ensure that ground motions greater than Modified Mercalli Intensity VI are conservatively identified as exceeding the OBE. Based on direct correlations of the criterion parameters with damage data, ground motions which cause damage to buildings of good design and construction (which in general are not as seismically strong as nuclear facilities) are a factor of at least 1.5 larger than the recommended criterion threshold values. This ensures adequate conservatism in the criterion. Issues related to OBE exceedance, including the history of the OBE, regulatory and operational issues, plant operation concerns, current industry activities related to OBE exceedance and recent earthquake experience are discussed in the report.

45070 **(INIS-mf—11732) Chernobyl reactor accident and its impact on the Land Baden-Wuerttemberg.** (Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). Mar 1987. 139p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754161/JAW.

For better comprehension of the material presented, some basic facts and terms are first explained, followed by a brief description of the accident scenario. The impact on the Land Baden-Wuerttemberg is then explained by a review of the time-dependent deposition of the fallout, of the various compositions of the radioactive aerosols deposited in the different areas, by a detailed evaluation of measured data taken in free air, soil, waters, and food, and by an assessment of the resulting radiation exposure. (DG) With 23 coloured figs., 24 tabs.

45071 (INIS-mf—11752) Supervision and technical coordination of the German activities in the 2D/3D-project. Final report. Mayinger, F. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl A fuer Thermodynamik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). [1988]. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754319/JAW.

The German Federal Minister for Research and Technology, the Japanese Atomic Energy Bureau, represented by the Japan Atomic Energy Research Institute (JAERI) and the United States Nuclear Regulatory Commission (USNRC) made a contract to cooperate in the field of nuclear safety research with the aim to improve and to guarantee the safety of water-cooled nuclear reactors on an international basis by joint research activities in the 2D/3D-project. The necessity for these research activities results from gaps in the status of knowledge for a best-estimate analysis in emergency core cooling, from the legally established duty to minimize the radioactive emission to the environment as consequence of an incident, and from the effort to optimize the safeguard systems of nuclear reactors continuously and steadily. The activities which were performed in the frame of this project concentrated on the coordination of the experimental and theoretical work, as well as on the technical supervision with respect to an efficient attainment of the internationally aspired research aim and to an optimal adjustment with respect to the emergency core cooling problems of pressurized water reactors.

45072 (LA—11308-PR) Space nuclear safety program: Progress report, April-June 1987. George, T.G. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013068/JAW.

This quarterly report describes studies related to the use of $^{238}PuO_2$ in radioisotope power systems, carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed are ongoing; the results and conclusions described may change as the work progresses.

45073 (NRL-R—3007(W)) Review of decontamination techniques in relation to decommissioning. Jones, J.M.; Wakefield, J.R. (UKAEA Northern Research Labs., Windscale). Dec 1987. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754145/JAW.

A review is presented of decontamination procedures currently in use in relation to the decommissioning of nuclear plant. Contributions were invited from Canada, France, Japan, Sweden, USA and the UK and are appended. They present an overview of the techniques employed in each country and identify areas of future development.

45074 (NUREG/CR—4508) Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel. Frid, W. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1988. Contract AC04-76DP00789. 161p. (SAND—85-1726). NTIS, PC A09/MF A01 - GPO. Order Number TI88014292/JAW.

Discharge of the molten core debris from a pressurized reactor vessel has been recognized as an important accident scenario for pressurized water reactors. Recent high-pressure melt streaming experiments conducted at Sandia National Laboratories, designed to study cavity and containment events related to melt ejection, have resulted in two important observations: (1) Expansion and breakup of the ejected molten jet. (2) Significant aerosol generation during the ejection process. The expansion and breakup of the jet in the experiments are attributed to rapid evolution of the pressurizing gas (nitrogen or hydrogen) dissolved in the melt. It has been concluded that aerosol particles may be formed by condensation of melt vapor and mechanical breakup of the melt and generation. It was also shown that the above stated phenomena are likely to occur in reactor accidents. This report provides results from analytical and experimental investigations on the behavior of a gas supersaturated molten jet expelled from a pressurized vessel. Aero-hydrodynamic stability of liquid jets in gas, stream degassing of molten metals, and gas bubble nucleation in molten metals are relevant problems that are addressed in this work.

45075 (NUREG/CR—4639-Vol.4-Pt.3) Nuclear computerized library for assessing reactor reliability (NUCLARR): User's guide: Part 3, NUCLARR system description. Gilmore, W.E.; Gentillon, C.D.; Gertman, D.I.; Beers, G.H.; Galyean, W.J.; Gilbert, B.G. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 222p. (EGG—2458-Vol.4-Pt.3). NTIS, PC A10/MF A01 - GPO. Order Number TI88013647/JAW.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities. The NUCLARR system is documented in a five-volume series of reports. Volume IV of this series is the User's Guide for operating the NUCLARR software and is presented in three parts. This document, Part 3: NUCLARR System Description, provides an in-depth discussion of the design characteristics and special features of the NUCLARR software. Part 3 also presents the organization of the data base structures and techniques used to manipulate the data.

45076 (NUREG/CR—4639-Vol.5-Pt.1) Nuclear computerized library for assessing reactor reliability (NUCLARR): Data manual: Part 1, Summary description. Gertman, D.I.; Gilbert, B.G.; Gilmore, W.E.; Galyean, W.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 120p. (EGG—2458-Vol.5-Pt.1). NTIS, PC A06/MF A01 - GPO. Order Number TI88013648/JAW.

This volume of a five-volume series summarizes those data currently resident in the first release of the Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) data base. The raw human error probability (HEP) and hardware component failure data (HCFD) contained herein are accompanied by a glossary of terms and the HEP and hardware taxonomies used to structure the data. Instructions are presented on how the user may navigate through the NUCLARR data management system to find anchor values to assist in solving risk-related problems. Volume V: Data Manual will be updated on a periodic basis so that risk analysis without access to a computer may have access to the largest NUCLARR data. This document Part 1 of Volume 5 introduces aspects of the NUCLARR data base management system and prepares the reader for reviewing data in other Parts of Volume 5.

45077 (NUREG/CR—4639-Vol.5-Pt.2) Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): Part 2, Human Error Probability (HEP) estimates: Data manual. Gertman, D.I.; Gilbert, B.G.; Gilmore, W.E.; Galyean, W.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. 814p. (EGG—2458-Vol.5-Pt.2). NTIS, PC A99/MF A01 - GPO. Order Number TI88013642/JAW.

This volume of a five-volume series summarizes those data currently resident in the first releases of the Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) data base. The raw human error probability (HEP) contained herein is accompanied by a glossary of terms and the HEP and hardware taxonomies used to structure the data. Instructions are presented on how the user may navigate through the NUCLARR data management system to find anchor values to assist in solving risk-related problems.

45078 (NUREG/CR—4639-Vol.5-Pt.3) Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): Data manual: Part 3, Hardware Component Failure Data (HCFD). Gertman, D.I.; Gilbert, B.G.; Gilmore, W.E.; Galyean, W.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. 453p. (EGG—2458-Vol.5-Pt.3). NTIS, PC A23/MF A01. Order Number TI88013643/JAW.

This volume of a five-volume series summarizes those data currently resident in the first release of the Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) data base. The hardware component failure data (HCFD) contained herein are accompanied by a glossary of terms and the HEP and hardware taxonomies used to structure the data. Instructions are presented on how the user may navigate through the NUCLARR data management system to find anchor values to assist in solving risk-related problems.

45079 **(NUREG/CR—4639-Vol.5-Pt.4) Nuclear computerized library for assessing reactor reliability (NUCLARR): Data manual: Part 4, Summary aggregations.** Gertman, D.I.; Gilbert, B.G.; Gilmore, W.E.; Galyean, W.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 312p. (EGG—2458-Vol.5-Pt.4). NTIS, PC A14/MF A01 - GPO. Order Number TI88013645/JAW.

This volume of a five-volume series summarizes those data currently resident in the first release of the Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) data base. The raw human error probability (HEP) and hardware component failure data (HCFD) contained herein are accompanied by a glossary of terms and the HEP and hardware taxonomies used to structure the data. Instructions are presented on how the user may navigate through the NUCLARR data management system to find anchor values to assist in solving risk-related problems. Volume V: Data Manual will be updated on a periodic basis so that risk analysts without access to a computer may have access to the latest NUCLARR data. This document, Part 4 of Volume 5, offers NUCLARR HEP and HCFD Summary aggregations.

45080 **(NUREG/CR—5158-Vol.1) Worldwide activities on the reduction of occupational exposure at nuclear power plants.** Kahn, T.A.; Baum, J.W. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 38p. (BNL-NUREG—52086-Vol.1). NTIS, PC A03/MF A01 - GPO. Order Number TI88013769/JAW.

This report is based on analysis of an informational data base set up at the Brookhaven National Laboratory ALARA Center. It is part of a project sponsored by the US Nuclear Regulatory Commission to monitor and evaluate research on dose reduction at nuclear power plants in the US and abroad. The main benefits to be expected from reducing occupational exposures are highlighted in the report, the chief causes of elevated doses are identified, and effective approaches to minimize radiation exposures are proposed. A wide range of research activity is covered, including plant chemistry, cobalt reduction techniques, stress corrosion cracking, decontamination, remote tools and devices, and robotics. Advanced reactors, which are designed for low radiation exposures, are examined, and health physics technology programs which have been effective in reducing occupational exposure at various utilities are discussed. The highlights of the programs on dose reduction conducted by a number of countries are described, and comparisons are made of the collective occupational radiation dose equivalents for selected countries. The short and long term trends such studies are pointing to are evaluated. It is concluded that the efforts to improve dose reduction, both in the US and abroad, remain in a healthy state but require continuing encouragement and further development.

45081 **(SAND—88-0122C) Expert opinion in risk analysis: The NUREG-1150 methodology.** Hora, S.C.; Iman, R.L. (Hawaii Univ., Hilo (USA); Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-880601—36). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012390/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

The Reactor Risk Reference Document [US Nuclear Regulatory Commission, 1987] is the most comprehensive study and application of probabilistic risk analysis and uncertainty analysis methods for nuclear power generation safety since the Reactor Safety Study [US Nuclear Regulatory Commission, 1975]. Many of the issues addressed in PRA work such as NUREG-1150 involve phenomena that have not been studied through experiment or observation to an extent that makes possible a definitive analysis. In many instances, the rarity or severity of the phenomena make resolution impossible at this time. In these instances, the best available information resides with experts who have studied the phenomena in question. This paper is about a reasoned approach to the acquisition of expert opinion for use in PRA work and other public policy areas.

45082 **(SAND—88-0154C) Investigations to determine whether Section XI of the ASME [American Society of Mechanical Engineers] Boiler and Pressure Vessel Code should include PLEX [plant life extension] baseline inspection guidance.** Bustard, L.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880886—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012704/JAW.

From ANS topical meeting on nuclear plant life extension; Snowbird, UT, USA (3 Aug 1988).

A plant life extension (PLEX) issue repeatedly mentioned is whether special PLEX supplemental inspection requirements should be added to Section XI of the ASME Boiler and Pressure Vessel Code. To assist the ASME answer this question, the DOE Technology Management Center performed an industry survey to assess whether there was a technical consensus regarding the desirability and scope of a supplemental PLEX baseline inspection. This survey demonstrated the lack of an initial industry consensus. In response to the survey results, ASME has formed a task group to investigate various PLEX supplemental inspection strategies and to assess their value and liabilities. The results of the survey and initial task group activities are reviewed.

45083 **(WHC-SA—0275) Comparison of reactivity feedback models for the FFTF passive safety tests.** Padilla, A. Jr.; Hill, D.J. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 7p. (CONF-880506—21). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013580/JAW.

From Safety of next generation power reactors; Seattle, WA, USA (1 May 1988).

The FFTF Loss-of-Flow-Without-Scram Test from 50% power to natural circulation flow was analyzed with the SASSYS code using both the SASSYS reactivity feedback models and the semiempirical reactivity feedback equations for the FFTF oxide-fuel core. The experimental data for primary loop flow and reactor power were used as inputs to obtain the same fuel, sodium, and structure temperatures for both sets of reactivity feedbacks. A detailed comparison was made for each of the reactivity feedbacks: Doppler, sodium density, control rod expansion, axial fuel expansion, radial expansion, and bowing. The major differences between the SASSYS reactivity models and the FFTF reactivity equations were in the radial expansion and bowing feedback. The sensitivity of the results to the input for the SASSYS radial expansion and bowing model was investigated.

25 ENERGY STORAGE

2504 Capacitor Banks

REFER ALSO TO CITATION(S) 45089

2506 Thermal

REFER ALSO TO CITATION(S) 45566

45084 **(BFR-R—8-1987) Increased heat abstraction from lakes during the winter. Methods of accelerating ice formation on lakes in order to increase the amount of energy stored in them during the winter.** Lindahl, S.; Svensson, J.; Moberg, M. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 26p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88753671/JAW.

The objective of this work has been to investigate the theoretical and practical feasibility of reducing the effects of windin-

duced mixing. The theoretical work has considered the use of artificial flow barriers and the feasibility of influencing the ice formation process by means of 'artificial' density stratification through supplying extremely cold surface water to the lake. The work showed that both methods should give favourable results. Practical work consisted of testing the use of flow barriers, which in this case consisted of oil-collecting booms. The results indicated that booms have a beneficial effect on the ice formation process. Reliably quantifiable energy gains could not be measured, due to the large natural variations in the lake heat content from year to year. However, the conclusion was that the effect of booms must be favourable due to the demonstrated acceleration of the ice formation process. (authors).

45085 **(BFR-R—23-1987) Energy storage in clay. Heat flow, heat exchanger design and alteration of the geotechnical characteristics of the clay.** Adolfsson, K.; Saellfors, G. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 142p. (In Swedish). NTIS (US Sales Only), PC A07. Order Number DE88753676/JAW.

This project deals with investigation of problems associated with heat storage in clay. Used as a heat storage medium, clay has the advantage of a relatively high thermal capacity, low heat losses after some years and relative ease of installation of heat exchangers. Adverse characteristics are associated with the fact that the geotechnical characteristics of the clay are degraded with increasing temperature. The objective of this work has been primarily to investigate how the characteristics of the clay change, and the magnitude of settlement that can be expected in the long term. Two heat stores have been built and tested in full scale for the project. A large number of measurements of temperatures, pore pressures and deformations have been made in and around both stores. The measured temperature changes have shown that temperature conditions can be calculated using the known relationships governing heat flow through solid bodies. The geotechnical characteristics of clay are affected by heating. The most important factor is the reduction in the preconsolidation pressure of the clay, resulting from an increase in temperature. This means that the heat storage capacity of a normally consolidated clay gradually results in noticeable settlement as time goes on. (authors).

45086 (EPRI-EM—5454-SR, pp 9.1-9.7) **Ice storage system testing results.** Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). Oct 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920086/JAW. (CONF-870273—). Contract AC05-84OR21400.

From Seminar on commercial cool storage: state of the art; Denver, CO, USA (19 Feb 1987).

A laboratory facility for testing ice storage systems has been constructed and has begun operation. The facility is designed to test dynamic ice makers and ice-on-coil systems up to 250 T-h capacity according to a uniform test procedure. A 40 hp dynamic ice maker was installed as the first test unit and initial tests in the chiller and ice-making modes have been performed.

45087 (NEDOJ—8703, pp 376-388) **Development of energy storage system equipped with superheat pump (thermochemical heat storage technique, refrigeration heat storage type, clathrate application).** Saji, Toyotake. (Mitsubishi Heavy Industries, Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

In a study conducted under the Moonlight Program, a refrigeration chemical storage technique is applied to the development of a superheat pump energy storage system using clathrate. Results are presented in this report. When R-11, R-12 or clathrate, which requires water, is employed, the corrosion resistance of SUS 304 is the greatest, followed by Cu and SS 41 in this order. SS 41 can serve for practical application at temperatures below 30°C. R-11 is better in consideration of the production and decomposition of clathrate. R-12 is not suitable for direct expansion systems. The use of an additive prevents superheating, promotes the production of clathrate and reduces the decomposition time. In an indirect system, clathrate, unlike ice, will not be deposited on the surface of the heat transfer pipes and, if an additive is added, no extreme decrease in total heat transfer coefficient will occur up to a production rate of 40 percent, permitting smooth production and decomposition of clathrate required for a practical system. R-11 is the most suitable medium. Though requiring a large investment, this refrigeration system has many advantages and can match conventional systems using water and ice. (12 figs, 5 tabs)

45088 **(NP—8770329) Development of a finned-tube latent heat storage unit for cold stream compression systems.** Nachtrodt, M. (Dortmund Univ. (Germany, F.R.). Abt. Chemietechnik). 5 Jun 1986. 143p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770329/JAW.

Four different latent heat storage media on a salt hydrate basis were developed and tested for long-term stability by adding a few per cent by weight of nucleation media and the thickener. An experimental facility for refrigerant evaporation or condensation in the core tubes of finned-tube latent heat storage units was developed. The heat fluxes could be approximated in a satisfactory manner by taking the mean.

2508 Chemical

REFER ALSO TO CITATION(S) 45087

2509 Batteries

REFER ALSO TO CITATION(S) 45465

45089 **(AD-A—192440/6/XAB) High-power pulse energy system concept. Final report, 1 September 1987-28 February 1988.** Lee, H.L.; Mason, G.; Kern, K. (Pinnacle Research Inst., Cupertino, CA (USA)). 28 Feb 1988. 52p. NTIS, PC A04/MF A01.

New advances in capacitor technology create exciting opportunities in size and weight reduction for high-power, pulse energy systems having a broad range of applications. Characteristics of a proposed high-power pulse energy system, formed by combining a recently developed, high-energy density capacitor with various batteries were investigated. Main advantages of the system thus far appear to be high power and pulse energy density and flexibility in energy outputs. Parametric relationships between most key design variables, such as average pulse power, system output voltages, load impedance, pulse width, pulse frequency, duty cycle and battery's voltage and current limits were established. Projections of the system's weights in large scale applications suggested that the lithium/SO_2 battery considered might be too heavy when high duty cycles were required. However, significant weight reductions could be foreseen with proper selection of the battery and further advances in the capacitor technology.

45090 **(AD-A—192816/7/XAB) Results from life test in progress on Eagle-Picher nickel-cadmium cells. Technical report.** Badcock, C.C.; Donley, S.W.; Hwang, W.G.; Matsumoto, J.H.; Poston, T.M. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 1 Apr 1988. 23p. (TR—0086A(2945-01)-7). NTIS, PC A03/MF A01.

This report summarizes the results from low-earth-orbit life testing on Eagle-Picher nickel-cadmium cells of nominal 50 Ah capacity that have been undergoing testing since 1983. As these cells have limited ability to withstand overcharge, a V-T charging scheme was adopted at the outset after careful determination of safe peak-charge voltages at the two operating temperatures of 0 and 20 C. Of the original 30 cells put on life cycling under a complex load profile (10 cells each of 0 C/25% maximum depth-of-discharging (DOD), O C/40% maximum DOD, and 20 C/25% maximum DOD), both cell packs at 0 C were discontinued after less than 5000 pack at 20 C has exceeded 15,000 cycles (in May 1987), with no evidence of voltage spreading or other serious decline in performance. The original V-T level selected for this pack has not required adjustment.

45091 (NEDOJ—8703, pp 351-375) **Research and development of new battery energy storage system. Research and development of sodium-sulfur battery.** Kita, Akira. (Yuasa Battery Co., Ltd., Osaka, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This report deals with the progress, made until 1985 and in 1986, of development of a new-type battery energy storage system which was carried out as part of the Moonlight program beginning in 1980. Efforts were focused on development of sodium-sulfur batteries, which was started with studies on elements including electrolyte and electrodes, followed by development of 150Ah and 300Ah cells and investigations of techniques for performance measurement, safety and mass production. Several cells were combined into 1 kW and 10 kW batteries. Testing showed that the batteries have efficiencies of 82 to 86 %. Studies in 1986 were focused on apparatus for testing the through holes in solid electrolyte tubes; properties of graphite material as anode conductor; cost reduction, corrosion resistance and heat stress in anode metal; and breaking strength of the batteries. For them to operate at 350°C, a high-performance heat insulating container was development and applied to the construction of No.3 and No.4 batteries of a 10 kW class, which were then subjected to testing. Their energy efficiency were 77 % (AC-AC), achieving the target value. Mass production was shown to be possible.(17 figs, 9 tabs, 10 photos)

45092 (NP—8770283) **Organometallic oligomers and polymers for use in secondary batteries.** Andrejewski, D. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften). 22 Jan 1987. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770283/JAW.

The syntheis, characterisation and electrochemistry of organometallic oligomers and polymers are discussed with a view to their application as electrode materials in polymer secondary batteries.

45093 **Overcharge protection in Li-alloy/metal disulfide cells.** Redey, L. (Argonne National Lab., Chemical Technology Div., 9700 S. Cass Avenue, Argonne, IL (US)). pp 631-636 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Charge and overcharge reactions of FeS/sub 2/, NiS/sub 2/, and (Fe-Ni)S/sub 2/ electrodes were studied in half-cell and full-cell experiments to investigate the electrochemical stability of these materials at high charge potentials. In Li/sub 2/S-saturated (LiCl-KCl, LiF-LiCl-LiBr, and LiCl-Li-Br-KBr) electrolytes, a new plateau appeared at 2.05 - 2.1 vs. Li-Al and was associated with polysulfide anion formation. The polysulfide seems to stabilize the transition-metal sulfides against overcharge-related dissolution, even at 2.2. V. The anodically formed polysulfide provides overcharge tolerance for Li-alloy/MS/sub 2/ cells by an electrochemical-chemical sulfide/polysulfide cycle.

45094 **Evaluation of LiCl-LiBr-KBr electrolyte for Li-alloy/metal disulfide cells.** Kaun, T.D. (Argonne National Lab., Chemical Technology Div., 9700 South Cass Avenue, Argonne, IL (US)). pp 621-630 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

The physical properties of a new molten salt electrolyte for lithium-alloy/metal disulfide cells, 25 mol % LiCl-37 mol % LiBr-38 mol % KBr, were investigated. In earlier cells, a LiCl-KCl electrolyte was used. Cyclic voltammetry of FeS/sub 2/ in the molten salt at 375-425°C indicated improved electrochemistry and stability of the reaction on the upper voltage plateau (1.75 V vs. LiAl). The new electrolyte provides an opportunity to operate an upper-plateau (U.P.) FeS/sub 2/ electrode at a lower temperature, 400°C, and with a higher activity of lithium ion in the electrolyte. The broad liquidus of this molten salt at 400° also supports operation at high current density. Testing at 24- to 48-Ah cells indicated greater than 50% improved energy and power density over the conventional two-plateau FeS/sub 2/ cell with LiCl-KCl electrolyte. The conventional FeS/sub 2/ cells would lose 50% of their upper-plateau capacity within 200 cycles. The elimination of this capacity decline problem was demonstrated by 400 cycles and 5400 h of stable operation with a dense U.P. FeS/sub 2/ electrode cell, which maintained 89% utilization of theoretical capacity throughout the test.

29 ENERGY PLANNING AND POLICY

45095 (NLVF/S—685) **Optimal utilization of energy resources in agriculture. Final report.** Jeksrud, W.K. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Feb 1987. 13p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753711/JAW.

The report presents the main conclusion from the project on the optimal utilization of energy resources in agriculture. The aim of the project was to analyse the various types of energy resources and methods of management for farms, and methods to utilize the existing resources. New approaches are briefly discussed. 5 drawings, 3 tables.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 45095, 45123, 45127, 45128

45096 (Juel-Spez—237) **Model of analysing the conversion capacities on the energy sector of the Federal Republic of Germany. Documentation. As of December 1983.** Heckler, R.; Pohlmann, M.; Schwefel, H.P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung). Aug 1984. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754147/JAW.

The objective of the model is to calculate the resulting primary energy consumption, with regard to the various sources of energy; and the necessary conversion capacities, with regard to the types of plants; the temporal course of consumption for each source of energy is given. Thus the essential given points of this model are: the final energy consumption (classified according to the 26 soures of energy), the non-energetic consumption (classified according to the 26 sources of energy), and the consumption of coke by the iron-producing industry (for the sphere of blast furnaces). The time period covered for the past is from 1950 until 1981; for the future, it is the period from 1982 until 1995. Progress is made in steps of 1 year each. Therefore, this is a time-discrete model. The region covered is the Federal Republic of Germany. Its basic figures for the past, the energy balances of the 'Arbeitsgemeinschaft Energiebilanzen' were used. Other sources, especially those relating to capacity-time sequences, are referred in the data sets commented on.

45097 (LIU-TEK-LIC—1986-33) **MODEST - a model for optimization of dynamic energy systems with time dependent components and boundary values.** Backlund, L. (Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering). Nov 1986. 194p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88753697/JAW.

A model for optimization of energy systems is developed. The optimizing criterium is to minimize the energy system cost during the period studied. The model is used to design a method for working out market adapted time-differentiated energy prices for electric power and district heating, and to analytically determine multidimensional areas of variation for system parameters in optimum system solutions. (L.E.). 58 refs.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 44830, 44971, 44972, 45035, 45114, 45120, 45129, 45132, 45460, 45819

45098 (ORNL—6468) Energy requirements for rural development. Jones, D.W. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013337/JAW.

This study on the role of energy in the development of rural areas was originally conducted in the spring and summer of 1985. It was intended to serve as a background paper for the preparation of a program plan for the Office of Energy of the United States Agency for International Development. As such it begins with a brief overview of how rural development fits into national development, then offers a comprehensive framework for thinking about rural development in particular and the energy implications of the various components of rural development. Agriculture naturally comes to mind when rural areas are mentioned, but industry is an important component of rural activity as well. Consequently, both agricultural and nonagricultural energy use is discussed. Modernization of rural areas will change household, as well as production, energy use. However, household energy use is a veritable subject in its own right, with a large literature. Consequently, that topic is discussed in less detail than the production energy topics.

45099 Modeling the regional economic impact of operating a military base: Modeling issues, options, and analysis. Kerley, C.R. (Energy Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 127-130 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

Data adjustment is an important component of modeling the economic impact of a military base. The number of secondary jobs support by a military base may be larger than the level of job loss experienced when the bases closes. Survey and case study information will indicate whether economic growth or other income and job substitution adjustments will absorb the economic loss.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 44546, 44668, 44698, 44700, 44771, 44783, 44800, 44830, 44942, 44943, 44944, 44945, 44946, 44947, 44948, 44949, 44950, 44951, 44952, 44953, 44954, 44956, 44957, 44958, 44959, 44960, 44961, 44962, 44963, 44964, 44965, 44966, 44968, 44969, 44970, 44971, 44972, 44973, 44974, 44975, 44976, 44977, 44978, 44980, 45067, 45263, 45428, 45430, 45431, 45454, 45455, 45456, 45492, 45493, 45564, 45663, 45677, 45678, 45693, 45703, 45704, 45744, 45778, 45779, 45780, 45820, 45849, 45850, 45851, 45852, 45853

45100 (ANL/ES—154) Pilot study of the relationship of regional road traffic to surface-soil lead levels in Illinois. LaBelle, S.J.; Lindahl, P.C.; Hinchman, R.R.; Ruskamp, J.; McHugh, K. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013158/JAW.

Leaded gasoline has been used as fuel for trucks and automobiles in the United States since 1924; it has been implicated as a source of lead that is deposited on the soil and eventually can be ingested by small children, contributing to their burden of this toxic metal. The lead content of 667 surface-soil samples (taken at depths of 0-5 cm) and 159 subsurface-soil samples (from depths of 25-30 cm) collected from Illinois play areas near roads was measured and related to traffic variables. The samples were collected between June and October of 1985, and their measured lead levels exceeded the average natural background level for Illinois soil. The highest lead concentrations were found in samples from the six-county metropolitan Chicago region, where both traffic volume and traffic density are higher than in the rest of the state. Regression analysis showed significant correlation of lead concentration in the top 5 cm of soil with three variables (traffic density, distance from the busiest nearby roadway, and traffic volume), in a log-log relationship. The lead levels in soil samples taken near high-volume roads in the six-county suburbs of Chicago were similar to those in samples taken near high-volume roads within Chicago. This pilot study shows that lead accumulates in soil away from painted structures and known industrial lead sources, in a pattern at least partially related to traffic activity on and distance from nearby roads. Further research is needed to (1) better define traffic density, to improve understanding of the mathematical correlation between traffic and soil lead levels; (2) evaluate soil characteristics that can affect lead concentration; and (3) develop a standard method for measuring the lead content of urban surface soils. 82 refs., 16 figs., 24 tabs.

45101 (EPRI/EA/EL—5612, pp 6.37-6.40) Statistically valid sampling strategies for PCB contamination. Ubinger, E. (IT Corp., Monroeville, PA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The sampling data taken during an assessment of buildings allegedly contaminated by PCBs are often required to meet many different intended ends. Because of this, the design of sampling strategies for building contamination assessment is a complex task. Through the use of appropriate statistical techniques, the optimal sampling plan may be developed to meet a set of site-specific objectives. 5 references, 2 figures.

45102 (PB—88-204730/XAB) Long-range research agenda for the period 1988-1992 (environmental protection agency, office of research and development). (Environmental Protection Agency, Cincinnati, OH (USA). Center for Environmental Research Information). Sep 1987. 86p. (EPA—600/9-87/022). NTIS, PC A05/MF A01.

See also report for 1986-1991, PB—85-224988.

The Long-Range Research Agenda is prepared in response to the Congressional requirement that the U.S. Environmental Protection Agency submit an annual revision of a comprehensive five-year plan for environmental research, development and demonstration not later than two weeks after the President submits his annual budget to the Congress. The annual revision is required to convey the plans for no-growth, moderate-growth, and high-growth budget projections and should include an explanation of the relationship to existing laws that authorize the environmental research, development, and demonstration. The budget projections contained in the report assume a 3% increase for the moderate-growth scenario and a 6% increase for the high-growth scenario. The budget projections are subject to change associated with new Agency priorities and the availability of funds.

45103 (PB—88-205398/XAB) Superfund: research, development, and demonstration strategy and program plan. (Environmental Protection Agency, Washington, DC (USA). Office of Research and Development). Sep 1987. 30p. (EPA—600/8-87/050). NTIS, PC A03/MF A01.

The research, development, and demonstration (RD&D) strategy not only describes the Office of Research and Development (ORD) Superfund research program but other ORD support relevant to the Superfund program mission. It is intended to guide the Superfund Office and the Agency in setting research priorities and allocating resources; to aid in coordination among Federal agencies that conduct Superfund-related research; and to assist ORD scientists and engineers in understanding the programmatic context of their work. The Superfund RD&D program is generally structured to conform with the Agency's risk-assessment and risk-management decision process. This research framework mirrors the procedures used in the Superfund Program: assessments are conducted at each site to determine specific health and ecological risks; then, if needed, options are formulated and evaluated to determine what remedial actions can be taken to reduce the risk to acceptable levels. Risk managers rely on this scientific and technical information to make cleanup decisions.

45104 **(PB—88-213194/XAB) Prevention reference manual: overviews on preventing and controlling accidential releases of selected toxic chemicals. Final report, October 1987-April 1988.** Davis, D.S.; DeWolf, G.B.; Ferland, K.A.; Quass, J.D.; Rueter, C.O. (Radian Corp., Austin, TX (USA)). May 1988. 211p. NTIS, PC A10/MF A01.

This manual can be used to orient personnel involved in inspecting and otherwise evaluating potential toxic-chemical release hazards to the fundamentals of release hazard control for 13 of the specific chemicals chosen for evaluation under Section 305(b) of the Superfund Amendments and Reauthorization Act (SARA) of 1986. It also guides the user to other technical literature for additional information. Section 305(b) requires that the EPA conduct a review of emergency systems for monitoring, detecting, and preventing releases of extremely hazardous substances at representative domestic facilities that produce, use, or store extremely hazardous substances. The EPA must also prepare and present to Congress a report with recommendations for initiatives for the development of technologies and systems for monitoring, detecting, and preventing the accidental release of chemical substances, and for public alert systems that warn of imminent releases.

45105 **(PB—88-866058/XAB) Solid-waste-disposal economics. March 1986-June 1988 (citations from the NTIS data base). Report for March 1986-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 65p. NTIS PC N01/MF N01.

Supersedes PB—87-855607.

This bibliography contains citations concerning economic aspects of solid-waste disposal. Topics include feasibility studies of specific waste-to-energy programs, materials recovery and recycling, and the utilization of fuel gases from landfills. Waste-material sources include industrial and municipal wastes, dredged materials, and waste derived from agricultural and mining operations. Considerable attention is given to Superfund records of decision at specific sites. (This updated bibliography contains 81 citations, 29 of which are new entries to the previous edition.)

2904 Natural Resources

REFER ALSO TO CITATION(S) 45121, 45127, 45128

45106 (NEI-NO—39, pp 8) **Public participation in water resource planning and policy-making.** Biswas, A.K. Jan 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88752091/JAW. (CONF-8605333—Vol.1).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

The paper reviews the background and discusses the various papers given for the session on public participation in water resources planning and policy-making. Because of varying physical, social, economic, legal, institutional, political and cultural problems, it is somewhat unlikely that one single method of public participation can be found that would be applicable in all projects in all countries. Following aspects are discussed: Public participation in water planning; public participation in water projects in developing countries. The primary focus is on multi- purpose water development projects.

45107 (NEI-NO—39, pp 20) **Decision support system and related methods in water resource planning.** Potier, M. Jan 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88752091/JAW. (CONF-8605333—Vol.1).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

The present paper deals with decision support systems and related methods in water resources planning. The various papers given for the session on economic quantification as a tool for decision making in water resources planning, reflect the change in emphasis from the quantity to quality viewpoint. Only a few of these papers deal with the economic aspects of water management from the quantitative viewpoint. The papers can be classified according to two main themes: the contribution of the feedback control theory, and of simulation and optimization models to decision making; the use of cost-benefit analysis or of benefit studies in decision making for water resources management in relation to environmental matters.

45108 (NEI-NO—40, pp 38) **Evaluating sites for energy facilities using decision analysis.** Keeney, R.L. Jan 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE88752092/JAW. (CONF-8605333—Vol.2).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

The paper deals with multicriteria decision making for the evaluation of sites for energy facilities using decision analysis. The analysis of complex siting problems is intended to help decision makers make responsible decisions and to provide logic and documentation supporting the decision for regulatory authorities, shareholders in companies involved, and the public. To achieve this, the analysis must address those features causing the siting complexity. These features include incommensurable environmental and economic impacts resulting from any decision, significant uncertainties about those impacts, knowledge from many disciplines necessary to describe the possible impacts, and the requirement to integrate all of the impact information in the evaluation process using value judgements. The decision analysis approach for siting is designed to address these features. Decision analysis is based on a set of logical principles. It provides procedures to obtain the information about possible economic, health, safety, environmental, socioeconomics, and political impacts of each siting alternative. Some of these procedures concern the systematic elicitation of necessary professional judgement and all include expression of uncertainties. Another aspect of decision analysis is the theory and procedures to quantify the value judgements necessary for appprasing impacts. These are all integrated in the methodology to evaluate sites and conduct sensitivity analysis. 1 drawing.

45109 (NEI-NO—40, pp 18) **Decision making in water resource planning: Models and computer graphics.** Fedra, K. Jan 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE88752092/JAW. (CONF-8605333—Vol.2).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

This paper describes some basic concepts of simulation-based decision support systems for water resources management and the role of symbolic, graphics-based user interfaces. Designed to allow direct and easy access to advanced methods of analysis and decision support for a broad and heterogeneous group of users, these systems combine data base management, system simulation, operations research techniques such as optimization, interactive data analysis, elements of advanced decision technology, and artificial intelligence, with a friendly and conversational, symbolic display oriented user interface. Important features of the interface are the use of several parallel or alternative styles of interaction and display, indlucing colour graphics and natural language. Combining quantitative numerical methods with qualitative and heuristic approaches, and giving the user direct and interactive control over the systems function, human knowledge, experience and judgement are integrated with formal approaches into a tightly coupled man-machine system through an intelligent and easily accessible user interface. 4 drawings, 42 references.

45110 (NEI-NO—40, pp 12) **Water resource planning an decision making: some thoughts about the future.** Kindler, J. Jan 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE88752092/JAW. (CONF-8605333—Vol.2).

From UNESCO symposium on decision making in water resource planning; Oslo, Norway (5 May 1986).

This paper reviews briefly some of the current concerns that much what is being developed to aid decision-making in water resources planning, is not easily finding its way into practice. Lack of proper communication between those who build analytic tools and the potential users of these tools seems to be one of the important reasons for this state of affairs. Following some discussion of the problems which may become specially important for water resources management in the years to come, attention is given to such relatively new planning aids as Decision Support Systems and Expert Systems, and some reflections are offered concerning their possible impact upon the character of the future planning efforts. Throughout the paper, papers submitted for the Symposium Session

/sup F/uture Possibilities/sup /are reviewed and commented upon. 25 references.

45111 **(NP—8770232) Congo People's Republic - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1987. 15p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770232/JAW.

The energy situation of Congo is reviewed on the basis of relevant data. Data on the country's national energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 44867, 45259

45112 **(BNL—52110) Brookhaven highlights, 1986-1987.** Rowe, M.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88012365/JAW.

The highlights of research conducted between October 1985 and September 1987 at Brookhaven National Laboratory are reviewed in this publication. Also covered are the administrative and financial status of the laboratory and a brief mention of meetings held and honors received. (FI)

45113 **(DOE/ID/12584—T1) Capabilities, programs, and economic benefits.** (UNC Geotech, Grand Junction, CO (USA)). [1988]. Contract AC07-86ID12584. 31p. (BP—002-0488-0.5K-A). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012179/JAW.

This document describes the activities and impacts of DOE's Grand Junction Project Office. Included are historical accounts of past programs, brief descriptions of current research and services, and evaluations of the economic effects of the facility on the local community and the state of Colorado. (TEM)

45114 **(ORNL—6475/V1) Energy Division annual progress report for period ending September 30, 1987: Volume 1.** (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013340/JAW.

The goals and accomplishments of the Energy Division of Oak Ridge National Laboratory are described in this annual progress report for FY 1987. The Energy Division has five major purposes, pursued through research, analysis, information dissemination, and management: (1) contribute to the effective resolution of energy-related issues, (2) conduct fundamental and applied research to improve decision-making processes, (3) improve the productive use of energy, (4) improve the effectiveness of electric power systems, and (5) achieve excellence in energy-related social science research. Consistent with the major purposes of the Division, the current research programs focus on four major areas: (1) analysis and assessment, (2) decision system research, (3) energy conservation aimed at improving energy end-use technologies, and (4) electric power systems.

45115 **(SAND—88-1821C) "S" glass manufacturing technology transfer.** Buckner, D.A.; McCollister, H.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-880631—16). NTIS, PC A02. Order Number DE88012665/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A glass-ceramic to metal sealing technology patented by Sandia National Laboratories, Albuquerque (SNL) was developed by MRC-Mound for use in the manufacture of weapon components. successful implementation attracted increasingly widespread weapons of this technology. "S-glass" manufacturing technology was transferred to commercial vendors to ensure that weapons production schedules would be met in the coming years. Such transfer also provided sources of this fledgling technology for the Department of Defense (DOD), aerospace and other commercial uses. The steps involved in the technology transfer are described, from the initial cooperative development work of Sandia and Mound scientists and technologists to the final phase of qualifying commercial vendors for component manufacture.

45116 **(UCRL—53868-87) Engineering research and development: Thrust area report, FY 87.** (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 308p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE88013792/JAW.

This annual report describes the accomplishments of the Engineering Research Program for fiscal year 1987. Fifty-eight research and development projects are covered. For each project, goal(s), technical description, and an overview of future work are provided.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 44728, 44777, 44800, 44814, 45034, 45112, 45647, 45781, 46211

45117 (IAEA-TECDOC—440, pp 347-351) **Public perception of fusion safety: Elements for a strategy.** Pages, J.P.; Rouyer, J.L. (CEA, Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France). Dept. de Protection Technique). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The paper addresses the link of fusion and fission safety and two surveys performed in France on samples of similar size and composition before and after the Chernobyl nuclear accident (February 1986 and June 1986 respectively). Comparison of the results obtained indicate on which aspects of nuclear power safety the public is most sensitive. (author). 3 refs, 1 tab.

45118 **(NUREG—0304-Vol.13-No.1) Regulatory and technical reports (abstract index journal): Compilation for first quarter 1988, January-March.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Jun 1988. 47p. NTIS, PC A03/MF A01 - GPO. Order Number TI88012963/JAW.

This journal includes all formal reports in the NUREG series prepared by the NRC staff and contractors; proceedings of conferences and workshops; as well as international agreement reports. The entries in this compilation are indexed for access by title and abstract, secondary report number, personal author, subject, NRC organization for staff and international agreements, contractor, international organization, and licensed facility.

45119 (SAAS—357, pp 17-25) **Role of nuclear energy for the energy policy of the German Democratic Republic.** Kraemer, J. (Ministerium fuer Kohle und Energie, Berlin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

Owing to the shortage of natural energy resources in the GDR, nuclear energy remains under the present conditions the only alternative to raw lignite for generating electricity to cover the growing energy requirements of the national economy. The proportion of nuclear energy in electricity generation will rise from 11 per cent in 1985 to 15 per cent in 1990. In the more than 20 years of large-scale use of nuclear energy in the GDR it has proved to be a safe and efficient component of the energy sector. The government of the GDR has long declared safety of nuclear power plants as the highest priority for managerial and all other staff employed in this field. Considering the consequences of the accident in the Chernobyl nuclear power plant further measures for ensuring and increasing safety of nuclear power plants in the GDR have been decided on.

45120 **Does the U.S. Government really help the private nuclear reactor market overseas.** Erb, D.E. (Office of Reactor Deployment, US Dept. of Energy (US)). pp 1-7 of Proceedings of the American Nuclear Society executive conference. Nuclear market needs: Domestic and international. La Grange Park, IL; American Nuclear Society (1986). (CONF-860105—).

From ANS executive conference on nuclear marketing - domestic and international; San Diego, CA, USA (12 Jan 1986).

The scope and effectiveness of the U.S. Government nuclear export policies and related nuclear programs are reviewed and analyzed. Included are major nuclear policy initiatives, beginning with President Eisenhower's Atoms-For-Peace Program, continuing through the enactment of the Nuclear Non-Proliferation Act, and concluding with the scope and efforts of the recently announced Interagency Task Force for Nuclear Exports. The roles, activities, and contributions of the Department of Energy (and predecessor agencies), the Export-Import Bank, the Agency for International Development, the Nuclear Regulatory Commission, and the Departments of State and Commerce are discussed. Finally, the paper concludes with a discussion of additional U.S. initiatives which, if pursued, could have a beneficial impact on the role of U.S. nuclear equipment, fuel, and services in foreign markets.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 45505

2910 Conservation

REFER ALSO TO CITATION(S) 45114, 45270, 45281

45121 **(DOE/PE/16037—T5) Analysis of the net energy use impacts of PURPA [Public Utility Regulatory Policy Act] electricity generation under alternative assumptions regarding the technology mix of PURPA generators and displaced utility generators: Final report.** (Eastern Research Group, Inc., Arlington, MA (USA)). Nov 1987. Contract AC01-84PE16037. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012311/JAW.

The goals of this study were to explore the magnitude of potential fuel savings (or increased fuel consumption) under different possible combinations of Qualifying Facilities generation and utility displacement, and to identify those combinations which might result in a net increase in fuel consumption. In exploring the impact of cogeneration net heat rate on net savings (or increase) in fuel consumption, the study also addressed the extent to which cogenerator efficiency affects the overall fuel use impact of Public Utility Regulatory Policies Act (PURPA) implementation. This research thus seeks to identify possible scenarios in which PURPA implementation may not result in the conversation of fossil fuels, and to define possible situations in which the FERC's efficiency standard may lead to energy-inefficient Qualifying Facility development. 9 refs., 6 figs., 6 tabs.

45122 **(STF—11A87041) Heating technics and thermodynamics.** Lorentzen, G. (SINTEF, Trondheim (Norway)). Jun 1987. 12p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753730/JAW.

The report deals with the conversion of energy, and compares the various thermodynamic conditions for the efficient use of energy resources. An exergy analysis by means of the Carnot cycle is given, and aspects on the future development of energy systems are briefly discussed. 4 drawings.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 44619, 44635, 44674, 45098, 45134, 45781

45123 **(DOE/PE—0083) The links between weather-normalized electric demand and economic growth for the United States and nine census divisions, 1977-1985.** (USDOE Office of Policy, Planning and Analysis, Washington, DC. Office of Electricity, Coal and Nuclear Policy). May 1988. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88014587/JAW.

This study establishes that a relationship between electric demand growth and economic growth still exists. To some extent, economic growth continues to drive electric demand growth in every region of the Nation. And this means a growing economy will create the need for new electric power supply. Furthermore, this study shows the extent to which electric demand varies with the weather. By filtering out the effects of abnormal weather, it demonstrates that the apparent relationship between electric demand and the economy cannot be attributed to a recent spate of cold winters or hot summers. Rather, the relationship is about what one would expect under normal weather conditions. In adjusting for weather effects, this study makes certain improvements on earlier studies. In general, past work on the relationship between weather and electric demand has assumed that the impact of weather on demand remains constant over a long period of time. This makes it difficult to see how the impact of weather may have changed from year to year with the increasing use of electric heat pumps and air conditioning. In addition, earlier work has focused almost exclusively on the Nation as a whole, neglecting to show how the impact of weather varies among its geographically and economically diverse regions. This technical study describes the results of a regional analysis that normalizes demand for weather, effects on a quarterly basis over the nine-year period from 1977 through 1985. 5 tabs.

45124 **(NP—8770222) Angola - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1987. 12p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770222/JAW.

The energy situation of Angola is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

45125 **(NP—8770223) Ireland - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1987. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770223/JAW.

The energy situation of Ireland is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

45126 **(NP—8770230) Senegal - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1987. 19p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770230/JAW.

The energy situation of Senegal is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in petroleum production and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

45127 **(NP—8770233) Togo - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Nov 1987. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770233/JAW.

The energy situation of Togo is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

45128 **(NP—8770234) Jamaica - energy situation 1986.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1987. 12p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770234/JAW.

The energy situation of Jamaica is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments. (UA)

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 44728, 44777, 45035, 45120, 45121, 45124, 45125, 45126, 45263

45129 **The policy-cost index approach to modeling change in input-output coefficients: An application to acid rain policy.** Hannan, M.; Rose, A. (Dept. of Mineral Resource Economics and Regional Research Institute, West Virginia Univ., Morgantown, WV (US)). pp 81-86 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

This paper presents a new approach to modeling technological change induced by government regulation. The methodology capitalizes on readily available data on equipment design specifications and prices to estimate trend functions that can be applied to the technical coefficients of an I-O model. The methodology is illustrated by an evaluation of the price impacts of recently proposed acid rain control legislation.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 44546, 44631, 44635, 44661, 44674, 44677, 45269

45130 **(NP—8012507) Offshore Scientific and Technical Publications [1986–1988].** (Minerals Management Service, Vienna, VA (USA). Office of Offshore Information and Publications). Win 1988. 26p. Minerals Management Service, MS 642, 1951 Kidwell Drive, Rm 536, Vienna, VA 22180. Order Number TI88012507/JAW.

This catalog lists all current (1986-1988) scientific and technical publications of the Offshore Minerals Management Program. The catalog is updated and released on a quarterly basis in winter, spring, summer, and fall.

45131 **(NP—8770248) On the subject of Switzerland's adjustment of mineral oil prices to the international development. Empirical tests of several hypotheses.** Kirchgaessner, G. (Osnabrueck Univ. (Germany, F.R.). Fachbereich Wirtschaftswissenschaften). Mar 1987. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770248/JAW.

Since the end of 1985 we have observed a strong deduce in price on the international mineral oil markets, which, in addition, is accompanied by a decline in the Dollar-France-rate of exchange. This has led to considerable price reductions in the mineral oil prices in Switzerland. However, with this the question about the symmetry or asymmetry of the reactions of the mineral oil firms gains considerable significance. In this work, therefore, this question is examined with the help of econometric procedures. At the same time, the question arises, how far the overrolling of the international price changes is successful in the long-term for the Swiss prices. This survey is carried out for the consumer- and wholesale-trade-prices for light heating oil and 4-star petrol, in which the monthly data from January 1972 to April 1986 are used. After the hypotheses examined are more precisely specified, theoretically-speaking, the empirical results are presented in the following sections. (orig./UA)

45132 **(PB—88-217039/XAB) Advanced appliance improvement: hi-input commercial pulse-combustion water heater. Final report, November 1987.** Hollowell, C.T.; Belles, F.E.; Kardos, P. (Forbes Energy Engineering, Inc., Springfield, MA (USA)). Nov 1987. 105p. NTIS, PC A06/MF A01.

See also report dated Nov 85, PB—86-174398.

This final report presents the accomplishments in the area of pulse-combustion-based high-efficiency commerciaL/industrial water heaters with targeted inputs of 500,000, 750,000 and 1,000,000 Btu/hr. Four engineering models were completed; two for a single 500,000 Btu/hr input, one for 750,000 Btu/hr input, and one for 1,000,000 Btu/hr input. The latter one is also capable of firing all three inputs with minor adjustments. All models have thermal steady-state efficiencies exceeding the target of 91%. Acoustic work, cost-reduction efforts and development of accessories were conducted on all models. The participating manufacturer will build five (5) manufacturing prototypes of one of the 500,000-Btu/hr-input water heaters for subsequent field testing.

2960 Electric Power

REFER ALSO TO CITATION(S) 44677, 44871, 44994, 45108, 45119, 46200

45133 **(AD-A—192417/4/XAB) Competitive procurement of electrical power. Master's thesis.** Ray, J.L. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 85p. NTIS, PC A05/MF A01.

This thesis set out to determine if it was possible or required for the Department of Defense to competitively procure electrical utility services (power). The research was conducted by archival research of legal rulings, industry and governmental publications, federal regulations, federal statutes, and federal policies. This was followed with field research and interviews with key individuals involved in utility management and utility procurement. It was determined that competitive procurement of electrical-utility services is not only possible, it is required. The thesis presents an overview of the electric-utility industry, a review of competitive procurement guidance and policies, and an analysis of several considerations and strategies for competitive procurement, and it provides conclusions and recommendations for actions and further study.

45134 **(EPRI-EM—5917-SR) Demand-Side Planning Program: Projects and products, 1974-1987.** Mathieu, D. (Electric Power Research Inst., Palo Alto, CA (USA); Nesbit (William) and Associates, Santa Rosa, CA (USA)). Jul 1988. 104p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012900/JAW.

The Electric Power Research Institute's Demand-Side Planning (DSP) Program develops tools, data, and methodologies to help electric utilities predict the pattern and amount of energy required by their customers, plan how best to meet this requirement, and influence electricity use to ensure that this requirement is met in a manner beneficial to both the customer and the utility. This work is accomplished through three subprograms: End-Use Assessment and Forecasting, Planning and Information, and Marketing Support. Products developed through the program apply to utility planning, assessment, forecasting, and marketing activities. Key areas for program research include forecasting and measuring utility energy requirements with and without demand-site management (DSM); defining a portfolio of appropriate utility programs and initiatives from among the variety of DSM options available, and integrating DSM planning with traditional supply-side planning; gaining a better understanding of utility customers, and developing methods for designing programs that better meet customer preferences. This report describes all major active and completed research projects undertaken by the DSP program since 1974, as well as products resulting from each project.

45135 **(EPRI-P—5830) Capital requirements for the US investor-owned electric utility industry, 1985-2005: Final report.** Kolbe, A.L.; Johnson, S.K.; O'Loughlin, M.P. (Electric Power Research Inst., Palo Alto, CA (USA); Putnam, Hayes and Bartlett, Inc., Cambridge, MA (USA)). Jun 1988. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012778/JAW.

In recent years, financial concerns have increasingly constrained the traditional utility planning focus, on engineering and economic tradeoffs. After a troubled period, however, many utilities have completed major construction programs and face fewer financial constraints in the near term, while other utilities hope to achieve this status shortly. At the same time, many utilities and regulatory commissions are reluctant to begin construction of large new plants, both because of current high reserve margins and because of past unhappy outcomes for ratepayers and investors when load growth proved lower than expected. This study examines the potential long-run financial constraints and risks the electric utility industry faces as a result of the current incentives to delay the start of major new projects as long as possible. The study analyzes industry-wide financial and operating data from 1985 to 2005 under several scenarios. The findings suggest that if the future is no worse than postulated in our scenarios, total construction expenditures and external funding requirements should be manageable at the national level. Also, the study finds that the cost of delaying new construction {en dash} although possibly significant {en dash} will depend critically on the relative prices of coal and natural gas which actually occur. Thus this report concludes that the possibility of significant future financial constraints does not appear to be a problem at the national level. There is good reason to believe, however, that there could be a problem under certain adverse conditions for specific regions and for individual utilities. Given the relatively large amount of external funds likely to be needed by some utilities in those situations and the risks investors may perceive in supplying these funds, financial constraints may cause some construction delays. 23 refs., 21 figs., 6 tabs.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 44661

45136 **(DOE/MA—0339) Annual report on in-house energy management: FY 1987.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Jul 1988. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014096/JAW.

Energy conservation achievements for Fiscal Year, 1987, are reviewed. The energy conservation program includes building energy and transportation energy consumption. This report covers program accomplishments at field offices, power administrations, energy technology centers, and petroleum reserves. (DWL)

2990 Unconventional Sources And Power Generation

45137 **(PB—88-204458/XAB) Achieving wood-energy potentials: evidence in northeastern Minnesota. Forest Service general technical report.** Bradley, D.P.; Lothner, D.C. (Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station). 1987. 90p. (FSGTR-NC—114). NTIS, PC A05/MF A01.

Contents include: wood-energy potentials in northeastern Minnesota; predicting multiproduct timber yield for long-term supply analyses; impacts of wood energy use on timber supply in northeastern Minnesota; an assessment of productivity and harvesting costs for various forest harvest systems; future market uncertainty: a case for short-rotation systems; estimating wood energy demand in northeastern Minnesota; economic impact of substituting local wood energy for imported fossil fuels; policy options to encourage wood energy use in northern Minnesota; engineering and economic considerations of wood-energy systems using wood chips and pellets.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

45138 **(DOE/ET/10815—123) [Operation of MHD Coal Fired Flow Facility]: Quarterly technical progress report, October-December 1987.** (Tennessee Univ., Tullahoma (USA). Space Inst.). May 1988. Contract AC02-79ET10815. 17p. (UTSI—88-01). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011117/JAW.

In this Progress Report UTSI summarizes the progress on a multitask research and development project encompassing the development of the steam bottoming plant technology for a Coal Fired MHD/Steam power plant. Current emphasis is on testing promising tube materials, removal of particulate from the flue gas by both electrostatic precipitator and baghouse, fouling of heat transfer surfaces, recovery of spent seed material and environmental intrusion. The results of a 65 hour test conducted during the quarter in the DOE Coal Fired Flow Facility (CFFF) are discussed. The application of advanced optical diagnostic measurement equipment by both UTSI and Mississippi State University (MSU) is summarized. Evolutionary changes to test hardware and facility equipment are reported.

45139 **(DOE/ID/01745—T17) Component Development and Integration Facility: Quarterly technical progress report, January 1-March 31, 1988.** (MSE, Inc., Butte, MT (USA)). 1988. Contract AC07-78ID01745. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014531/JAW.

The Component Development and Integration Facility (CDIF) is a major US Department of Energy magnetohydrodynamic (MHD) test facility in Butte, Montana. The CDIF is operated by MSE Inc. Within the nation MHD program, MSE personnel are responsible for performing integration testing of vendor-supplied MHD power train components at the CDIF to support the goal of commercialization. During the second quarter of FY 88, testing continued with checkout of modifications to the second-stage oxygen injection and iron oxide/oil slurry injection. A new CDIF record for peak power was set during 88-DIAG-11, when 1.65 MWe was achieved. 3 figs.

45140 **(DOE/PC/79662—T3) Space Power MHD [magnetohydrodynamic] System: Third quarterly technical progress report, 1 November 1987-31 January 1988.** (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.). 15 Mar 1988. Contract AC22-87PC79662. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013085/JAW.

This progress report of the Space Power MHD System project presents the accomplishments during 1 November 1987 through 31 January 1988. The scope of work covered encompasses the definition of an MHD power system conceptual design and development plan (Task 1). Progress included the following: Subcontracts were issued to the MIT Plasma Fusion Center and the Westinghouse R & D Center. The performance of the 100 MW 500 sec. power system was optimized and the design concept finalized, including mass and energy balances. Mass and cost estimates were prepared. A design review was held at DOE/PETC. This also included the review of the technical issues definition and of the R & D Plan. Following the review, a final iteration on the conceptual design was initiated. Formulation of the R & D Plan was continued. Preparation of the Task 1 R & D Report was initiated. 12 figs.

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 45027

3005 Fuel Cells

45141 (CONF-850511—Absts., pp 79-82) **Electric utility phosphoric acid fuel cell technology development.** Schiller, T.G.; Smith, M.J. (United Technologies Corp., Windsor, CT (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC21-83FE60338;AC01-79ET29079.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

United Technologies Corporation is conducting a number of component technology programs for electric utility phosphoric acid fuel cell power plant development. Construction and testing of short stacks containing twenty eight, 10-ft² cells, has successfully demonstrated functional and performance objectives as evidenced by a 1500 hour test. Endurance characteristics have been demonstrated in a 3.7 ft² short stack for 15,000 hours. A 91-inch single tube reformer was fabricated and tested for 1000 hours. Reformer operation at reduced burner flame temperature while maintaining efficiency and fuel conversion was also demonstrated on the 91-inch reformer tube. A full length, seven-tube segment of a single stage, naphtha vaporizer was also constructed and tested successfully for over 900 hours. An approach to testing commercial burners in high pressure reformer burner environments has been identified and a test vessel fabricated. A full-scale power switching pole for a two-bridge inverter system was fabricated and testing has begun. The power plant control architecture has been addressed. Suggested approaches were obtained from several control system manufacturers and the results have been evaluated and the preferred architecture defined.

45142 (CONF-850511—Absts., pp 95-101) **Cell fabrication, design, and operation of a solid oxide fuel cell generator.** Zymboly, G.E.; Reichner, P.; Makiel, J.M. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC02-80ET17089.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

High temperature solid oxide fuel cell (SOFC) technology has advanced to the point where a reliable device can be fabricated and operated over extended periods of time. A 24-cell generator has been built and tested, and designs are being developed for multi-kilowatt generators which contain hundreds, or even thousands, of these cells. These applications have produced a demand for increased cell production capability. It is now important to establish process parameters for scaling of equipment to a size that will permit economical fabrication of cells for these large SOFC generators. This paper describes the cell batch fabrication processes and equipment that have been developed, the design of the self-heating generator which incorporates these cells and the operating procedures and performance achieved.

45143 (CONF-850511—Absts., pp 102-106) **Performance and life test of a solid oxide fuel cell stack.** Isenberg, A.O. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC02-80ET17089.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

A new solid oxide fuel cell (SOFC) geometry and SOFC generator concept was introduced in 1981. In following years steady and significant advances have been made in developing reliable processes for cell fabrication as well as in demonstrating performance levels. The structure of solid oxide fuel cells (SFCs) and the method of cell interconnection in stacks has been previously reported. During the past few years no changes in cell geometry and basic operation were required, attesting to the sound principles of construction and operation. However, due to the inherently different methods of SOFC fabrication, as compared to other types of fuel cells, much time and effort was directed toward developing reliable fabrication of uncommon refractory materials used as SOFC components. This work is continuing and involves considerable activity in basic materials research as well as post-test analysis of cells. After demonstrating acceptable life performance in single cells (> 1500 hours), the author had such confidence in materials, processing, and performance of individual SOFCs that he initiated a life test of three interconnected cells in September of 1983. This paper describes the stack, its performance, test sequence, and the initial results of an ongoing post-test analysis.

45144 (CONF-850511—Absts., pp 107-110) **High temperature interactions at solid oxide fuel cell interfaces.** Lau, S.K.; Singhal, S.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC02-80ET17089.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

High temperature interactions such as chemical reaction and interdiffusion among various solid oxide fuel cell components are important in determining the performance and useful service life of the solid oxide fuel cell. A study is in progress at Westinghouse to evaluate the nature and extent of such possible interactions at various interfaces in the state-of-the-art thin film solid oxide fuel cell. This paper presents the results of the experiments conducted to investigate such interactions at the ZrO_2 (Y_2O_3) electrolyte and Sr-doped $LaMnO_3$ air electrode interface. Two types of experiments were conducted to evaluate the interactions at the electrolyte/air electrode interface: intrinsic reactivity studies and diffusion kinetics studies. The objective of the former was to identify the nature of the high temperature reactions such as compound or solid solution formation that might occur between ZrO_2 (Y_2O_3) and Sr-doped $LaMnO_3$; the objective of the latter was to investigate the rates at which the potential interactions, identified in the reactivity studies, might proceed.

45145 (CONF-850511—Absts., pp P2.12A-P2.12C) **Effect of H_2S and COS on the performance of phosphoric acid fuel cells.** Ross, P.N. Jr. (Lawrence Berkeley Lab., CA (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC03-76SF00098.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

The objective of this project was to determine in laboratory cells the tolerance of phosphoric acid fuel cells (PAFC) to hydrogen sulfide and carbonyl sulfide impurities in the anode feed gas. This objective arises from the interest in coupling fuel cells to coal gasifiers, and from the interest in expanding the fuel base for current PAFC technology to relatively heavy sulfur containing liquid fuels. EPRI supplied the compositions of three different coal gasifier effluent streams of interest to their coal gasifier/fuel cell program. These gas streams and their compositions are designated in a table. For the purposes of this study the author simplified the compositions for the laboratory gases to hydrogen-carbon monoxide mixtures (balance nitrogen) containing various levels of hydrogen sulfide and carbonyl sulfide. Therefore, this study did not include the possibly additive negative effect of the other impurities (particularly the olefins) present in real coal gasifier effluent.

45146 (CONF-850511—Absts., pp 158-161) **Molten carbonate fuel cell cathode material development.** Kucera, G.H.; Minh, N.Q.; Smith, J.L.; Mrazek, F.C. (Argonne National Lab., IL (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

Past experiments have shown that the candidate materials $LiFeO_2$ and Li_2MnO_3 meet all the requirements but conductivity. Under certain conditions, the conductivity of these materials was adequate for cell use, e.g., $LiFeO_2$ prepared in air. However, conductivity is strongly dependent on gas composition. The focus of the effort has been on examining the effect of synthesis and sintering environment on materials properties and on understanding the mechanisms of conduction. In the current study, materials are synthesized under a range of typical cathode gas compositions at 1- and 10-atm pressure. The resultant products are examined by X-ray diffraction analysis to determine nominal crystal structure, phases, and the lattice constants of the unit cell. This characterization aids in the identification of non-stoichiometrics of these stable compounds. The in-cell behavior of undoped candidate materials was evaluated by migration testing. In these tests, ion migration from the cathode is studied in a real fuel cell at 1-atm pressure. Informa-

tion on the net effect of cathode solubility and the stability of the dissolved species in the anode environment was obtained principally by post test analysis of the electrolyte structure.

45147 (CONF-850511—Absts., pp 166-169) **Thermodynamics of the corrosion of chromium and iron in molten carbonates.** Hsu, H.S.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC05-84OR21400.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

Because of rising energy costs, efforts have been focused on developing high efficiency molten carbonate fuel cells (MCFC). The current collector has to withstand cathodic gas environments on one side and anodic gas atmospheres on the other side. In searching for improved current collector materials, several researchers have investigated the corrosion of selected high temperature alloys in carbonate salts. The major alloying elements in such alloys include chromium, iron, and nickel. Recently, Shores and Singh have provided phase stability diagrams for Li-Fe-C-O and Li-Cr-C-O systems at 650°C under the assumption that the chemical activity of Li_2CO_3 = 0.0285. The present studies have extended the phase stability studies of iron and chromium to cover systems containing K_2CO_3 as well as Li_2CO_3. Predictions have been checked experimentally by directly reacting chromium and iron (and their oxides) with carbonate salts at 650°C. Reaction paths were determined by thermogravimetric analysis (TGA), differential thermal analysis (DTA), and X-ray diffraction (XRD). The computer program SOLGASMIX-PV was used to establish equilibrium phase relationships in the Cr-Li-K-C-O and the Fe-Li-K-C-O systems.

45148 (CONF-850511—Absts., pp 173-176) **Fate of sulfur contaminants at the ppm level in molten carbonate fuel cells.** Remick, R.J.; Vasil, D.R. (Institute of Gas Technology, Chicago, IL (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC21-83MC20212.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

It has been recognized for several years that ppm levels of sulfur contaminants, such as hydrogen sulfide, in fuels supplied to molten carbonate fuel cells have an adverse effect upon cell performance. It was reasoned that the sulfur poisoned the anode by occupying active sites on the surface of the nickel. This adsorption impacts upon the two most important processes at the anode, the electrochemical oxidation of hydrogen, and the water-gas-shift reaction. To ascertain the importance of the poisoning of the electrochemistry, a bench scale fuel cell was set up and operated in a manner which would not require the shift reaction to function at all. The two most important results of this test were the discovery that severe performance losses were experienced under conditions which did not require the shift reaction to operate and that the fuel cell performance did not recover when the cell was returned to clean gas operation. Such behavior is contrary to that expected for a surface adsorption mechanism. The hypothesis was then put forth that the poisoning of the electrochemistry was the result of a reaction between nickel and sulfide ions in the melt. To test this hypothesis a second bench cell was set up, and the results of this test confirm the hypothesis that the contaminant which poisons the electrochemistry is coming from the melt. Attention was then turned to the shift reaction. Results of this study indicate that while the shift reaction is affected somewhat by the sulfur contamination, it does not shutdown completely but continues at a rate that is more than sufficient to maintain a 75% fuel utilization.

45149 (CONF-850511—Absts., pp 177-181) **Development of internal reforming catalysts for the direct fuel cell.** Tarjanyi, M.; Paetsch, L.; Bernard, R.; Ghezel-Ayagh, H. (Energy Research Corp., Danbury, CT (USA)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW. Contract AC21-76ET11304.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

Molten carbonate fuel cell development effort at ERC has been emphasizing the direct use of methane as the anode fuel (Direct Fuel Cell, DFC). The hydrogen which is required for the electrochemical oxidation on the anode is obtained by steam reforming the methane within the fuel cell, thereby eliminating the need for external fuel processing. Most commercial reforming catalysts employ silica or alumina containing ceramic supports which are not stable in molten carbonates. Catalyst development has therefore emphasized preparation of high surface area nickel supported on ceramics which are stable in molten carbonates. A variety of catalyst structures suited to internal reforming of methane in the DFC have been produced. In-cell and out-of-cell test results with these reforming catalysts are discussed in this paper. DFC performance on methane is compared to that predicted by a model and the effects of catalyst activity and loading are analyzed. Post-test analyses and diagnostic testing are reviewed to interpret various catalyst decay mechanisms. Modeling of electrolyte transport to the catalyst bed and the effects of electrolyte contamination on catalyst activity and stability are also presented.

45150 (CONF-861008—Absts., pp 2-5) **Overview of R and D activities on the fuel cell in Japan.** Itoh, N. (New Energy Development Organization, Tokyo (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Agency of National Resources and Energy of MITI is promoting the 21st Century Energy Vision Investigative Committee to investigate policy themes and the energy supply structure for the year 2000. One of the themes regards the impact of technological development for the year 2000, and a wider selection at the supply and demand levels for energy resulting from utilization and energy conversion technologies such as cogeneration and fuel cells. It will also examine the possibilities for diversification of the energy supply sources. The final report, 21st Century Energy Vision, will suggest us how to introduce fuel cell into the energy supply system after the year 2000. This paper discusses the phosphoric acid fuel cell and molten carbonate fuel cell technologies, fuel cell application fields, and their potential markets.

45151 (CONF-861008—Absts., pp 6) **Fuel cell activities in the United States.** Kalhammer, F.R.; Gillis, E.A. (Electric Power Research Institute, Palo Alto, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Fuel cell development activities have been underway in the US for nearly thirty years. The level of effort and duration of these activities in the US has been greater than in any other country or continent, and there can be little doubt that the development programs currently underway in Europe and Japan are based on US technology. Most of the US developmental activities were begun long before the formation of the Department of Energy (or its predecessor Energy Research & Development Agency), the Electric Power Research Institute, and the Gas Research Institute. The National Aeronautics and Space Administration and the Department of Defense were the principal public sector R & D sponsors in the nineteen sixties. However, there were a number of privately sponsored programs underway as well aimed at many different applications, all of which contributed to the current technology base. This paper summarizes some of the early US fuel cell R & D programs and traces them to the present time. In addition, the near-term plans for public-sector sponsored R & D are described.

45152 (CONF-861008—Absts., pp 7-10) **Onsite fuel cell field testing results.** Racine, W.C.; Londos, T.C. (Science Applications International Corp., La Jolla, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

In December, 1983, the Gas Research Institute (GRI), the US Department of Energy (DOE), 36 gas and electric utilities and an industrial participant began field testing onsite fuel cell power plants manufactured by International Fuel Cells (IFC). These 40-kW power plants were installed at 36 different utility-selected sites throughout the USA and in Japan. A total of 42 plants were installed and are being tested in a variety of building types with wide variations in use patterns and energy system configurations. Power plant installation and operating experiences are discussed. Four conclusions are presented. (1) The utility participants encountered no insurmountable problems in designing, installing, operating and maintaining the power plants at their customers' sites. (2) The power plants met the project's availability and electrical efficiency goals. (3) The onsite fuel cell sites represent numerous market segments and provide varied electrical and thermal interfaces for

power plant testing. (4) Operational problems discovered during field testing are being resolved in a technology development effort.

45153 (CONF-861008—Absts., pp 12-16) **Special testing of electrical and thermal characteristics of a 40 kW onsite fuel cell.** Arcari, R.N.; Ishii, R.K.; Ferraro, V.D. (Consolidated Edison Co., New York, NY (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

This paper summarizes the purpose and results of special tests performed by Con Edison on a 40 kW fuel cell power plant at the Skyview Haven Nursing Home located in Croton-on-Hudson, New York. Con Edison is one of the 30 gas, electric, and combined utilities participating in the Gas Research Institute (GRI) 40 kW phosphoric acid fuel cell field test. Con Edison's unit began operation on June 3, 1985 and had accumulated 1590 hours of service when the field test was interrupted to perform the special tests to characterize thermal and electrical characteristics of the fuel cell. The paper first describes the fuel cell, special test objectives, and test procedures. Test results discussed include the electric and thermal performance, electric protection characteristics, and environmental emission testing.

45154 (CONF-861008—Absts., pp 17) **40 kW field test experience.** Arentsen, S.K. (Dayton Power and Light Co., OH (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

As part of the 40 kW Onsite Fuel Cell Field Test, The Dayton Power and Light Company installed a 40 kW fuel cell at a hotel in Dayton, Ohio in September 1984. Over the course of the field test the system provided electricity for use in the guest rooms of the hotel and supplemented the domestic water heating requirements of the facility. During the 14 months field test period, the fuel cell operated for 6227 hours producing 189,000 KWh and 148 million BTU of usable heat. Overall power plant availability was 60% with several months during the test at 100% availability. Utility personnel performed the majority of operation and maintenance work required on the system. Since this project was designated as a field test rather than a demonstration project, its main goal was to determine the operational feasibility of the fuel cell system while at the same time identifying areas for needed improvement. The operation of the fuel cell at DP & L along with those of other participants in the program helped to reveal specific subsystems requiring modification or design changes that need implementation prior to full scale commercialization. At the DP & L site, the following are examples of areas for improvement that were identified: cold weather operation - several components experienced freeze damage both during unit operation as well as while the system was shut down; heat recovery - local water supplies appear to have deposited scale on the fuel cell heat exchangers which reduced flow rates through the system and inhibited heat transfer; control logic - at times during the field test random, unexplained fuel cell shutdowns were experienced.

45155 (CONF-861008—Absts., pp 18-22) **Field experience with 40 kW fuel cell power plants at military bases.** Ferraro, V.D.; Taylor, R.W.; Lynch, G. (Science Applications International Corp., La Jolla, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The US Department of Energy (DOE), in cooperation with the Department of Defense (DoD), is sponsoring the field testing of four 40 kW fuel cell power plants at military bases in the US. The fuel cell power plants were scheduled to operate for one year at each site providing electricity and heat for space heating, domestic hot water and process heat. A complete data acquisition system (DAS) was installed at each site to monitor the power plants' performance. This paper describes site characterizations, power plant, site data collection, system performance, problems, and successes.

45156 (CONF-861008—Absts., pp 23-26) **On-site 40 kW fuel cell field test.** King, J.M.; Falcinelli, R.; Woods, R.R. (International Fuel Cells Corp., South Windsor, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

During the period 1982 through 1986, a 40-kW fuel cell power plant was designed, fabricated, and field tested. The 40-kW program evaluation was both comprehensive and intense. The 42 power plant sites in 21 states of the US and two locations in Japan provided exposure to a broad range of environments. The average power plant operated for over 6500 hours. Fourteen power plants exceeded 8000 hours of operation with the longest running unit operating for over 11,000 hours. Total operating experience exceeds 300,000 hours.

45157 (CONF-861008—Absts., pp 28-31) **Overview of the Westinghouse solid oxide fuel cell program.** Dollard, W.J.; Brown, J.T. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Westinghouse conceived the solid oxide fuel cell in 1958 during the course of corporate sponsored fundamental research on oxygen ion conductivity of cubic phase zirconia. The present state of solid oxide fuel cell technology has grown out of this work. Westinghouse devised both the tubular solid oxide fuel cell with axial interconnection strip and a seal-less generator concept that permits the interconnection of cells in an array with both series and parallel cell interconnection. The focus of the DOE program has been on coal derived fuel gases. Individual cells have delivered a peak power of 22 watts using a simulated reformate fuel. The culmination of the DOE program phase just completed was the designing, building, and testing of a 324 cell generator, called the 5 kW unit. Its purpose was to show that SOFC technology could be applied to a thermally self-sustaining generator encompassing key features of a large-scale power generating system. Objectives of further DOE work are given. Westinghouse has recently been awarded a contract with the Gas Research Institute for solid oxide fuel cell development. The ultimate objective of this program is the development of natural gas fueled cogeneration systems for application to the commercial and industrial sectors. The three phases of this program are discussed. Westinghouse has designed, built, tested, and delivered to the Tennessee Valley Authority a 400 watt SOFC generator module, very similar to their 24 cell unit tested on the DOE program, and installed it in a host test apparatus. This is briefly described and then the market potential of the SOFC technology is discussed.

45158 (CONF-861008—Absts., pp 32-35) **Development status of multi-cell solid oxide fuel cell generators.** Reichner, P.; Makiel, J.M. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Solid oxide fuel cell technology has seen major advances over the past few years. Tubular cells, with a thin-film electrolyte, were found to be stable during tests which approached 9000 hours duration. Cell fabrication techniques were developed which permit the production of the large cell quantities required for SOFC generators, and a 24 cell generator was built and tested. During the past year, testing of the 24 cell generator was continued and a 5 kW generator was fabricated and tested. Design and test results are given for both the 24 cell generator and the 5 kW generator.

45159 (CONF-861008—Absts., pp 36-39) **TVA test of SOFC subscale generator.** Stephenson, D.R. Jr.; Veyo, S.E. (Tennessee Valley Authority, Chattanooga (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Tennessee Valley Authority (TVA) has purchased a laboratory prototype 400-Watt Westinghouse Solid Oxide Fuel Cell (SOFC) generator module installed in a host test apparatus for the purposes of demonstrating the capabilities of the technology, providing independent corroboration of overall performance and reliability, and gaining familiarity with the technology. The generator, test apparatus, and test program are described and results are discussed. Conclusions to date include: (1) the test apparatus meets its design requirements for automatic unattended operation, and operation at set point conditions for load follow; (2) loss of electrical

load is without deleterious consequences; (3) there was no shipping damage to either generator or test apparatus.

45160 (CONF-861008—Absts., pp 40-43) **Monolithic fuel cell development.** Fee, D.C.; Blackburn, P.E.; Busch, D.E.; Claar, T.D.; Dees, D.W.; Dusek, J.; Easler, T.E.; Ellingson, W.A.; Flandermeyer, B.K.; Fousek, R.J.; Heiberger, J.J. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

A new fuel cell design, called the monolithic fuel cell, is being developed at Argonne National Laboratory. The monolithic design employs the same thin ceramic components used in other oxide fuel cells in a strong, lightweight honeycomb structure of small cells, and thus can achieve very high power per unit mass or volume. The light weight and low volume, as well as the efficiency and reliability of electrical systems, are advantageous is space and terrestrial systems. In the monolithic concept, fuel and oxidant are combined electrochemically in a ceramic cell at an operating temperature of 1100 to 1300 K. Cell components are fabricated as one piece, much like a block of corrugated paper-board. Fuel and oxidant are conducted through alternating passages in the stack. These passages formed from thin (0.025 to 0.100 mm) layers of the active cell components: electrolyte (yttria stabilized zirconia), cathode (strontium doped lanthanum manganite), anode (nickel-zirconia cermet), and the interconnection material (magnesium-doped lanthanum chromite) that connects cells in electrical series (bipolar plate). The corrugations also form the gas seal at the edges of the structure. Advantage is taken of the ability to fabricate the solid electrolyte and other solid cell components into shapes that cannot be achieved in liquid electrolyte systems. The paper describes the fabrication and status of the development of the monolithic fuel cell, and performance of individual cells and of arrays.

45161 (CONF-861008—Absts., pp 44-47) **Fabrication of a solid oxide fuel cell monolithic structure.** McPheeters, C.C.; Fee, D.C.; Poeppel, R.B.; Claar, T.D.; Busch, D.E.; Flandermeyer, B.K.; Easler, T.E.; Dusek, J.T.; Picciolo, J.J. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The monolithic fuel cell structure is a honeycomb-like structure with gas-flow passages built into the fuel and oxidant electrodes. The structure is comprised of the four solid-oxide fuel cell materials; electrolyte, anode, cathode, and interconnection. The gas channels in the electrodes have characteristic dimensions on the order of 1 to 2 mm. The Mod 1 design consists of alternating layers of anode electrolyte/cathode composite, which is corrugated, and cathode/interconnection/anode composite which is flat. Fuel and oxidant flow in alternate sections of the corrugation on opposite sides of the anode/electrolyte/cathode composite. This design provides a high power density because it has high electrolyte surface area per unit volume; however, the manifold arrangement for this design is relatively complex. The Mod 0 design consists of alternate flat layers of anode/electrolyte/cathode composites and cathode/interconnection/anode composites separated by corrugated anode and cathode layers to provide the fuel and oxidant flow passages. The anode and cathode corrugations are oriented at 90° apart to allow simple fuel and oxidant manifold design. The objective of this work is to develop the processes for fabrication of the Mod 0 Monolithic Fuel Cell, and to fabricate the first working fuel cells of this design.

45162 (CONF-861008—Absts., pp 52-55) **Nondestructive evaluation methods applied to solid oxide fuel cells.** Ellingson, W.A.; Sawicka, B.; McPheeters, C.; Mrazek, F.; Van Pelt, B. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The ANL solid oxide fuel cell (SOFC) design yields a rather complex structure after assembly. Therefore, for the greatest reliability, nondestructive evaluation (NDE) inspection should be conducted on individual laminates or subassemblies (e.g., 3-4 stacked cells). As with multilayer ceramic capacitors, detection of both delaminations and cracks is important, and NDE methods must be able to yield information as a function of depth into the SOFC as well as plan view information. Conventional radiography yields X-ray shadowgrams of an object and does not provide any information on the location of a defect relative to the thickness (z-axis) of the sample. Computed tomographic imaging, on the other hand, yields information on the z-axis location of defects, but presently not at a high spatial resolution. Other NDE methods, such as acoustic emission, are being studied in order to help determine desirable firing schedules (temperature range rates, hold times, etc.) for best reliability. This paper presents recent results on the application of several NDE methods that are being developed as part of the ANL SOFC program.

45163 (CONF-861008—Absts., pp 56-59) **Characterization of monolithic fuel cell components.** Dees, D.W.; Mrazek, F.C. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Electrochemical characterization of materials and components is an important part of the monolithic fuel cell development effort. The high power density of the monolith depends on achieving low dissipative losses in the bulk materials and at interfaces between materials. The bulk electrical/ionic conductivity of all cell materials has been determined over the range of temperatures (800-1000°C) and oxygen pressures (0.2 to 10^{-18} atm). Complex impedance methodology was utilized to determine the conductivity of the four fuel cell components as a function of temperature. A series of AC impedance studies has been performed on various three-layer (anode/electrolyte/cathode) composite samples. The studies were performed using a special vessel designed and built in this laboratory. The manifold in the vessel allowed for separate atmospheres to be established on each side of the composite. The fuel environment on the anode side was a mixture of H_2 and H_2O (H_2/H_2 0 = 97/3) which produced a partial pressure of oxygen equal to 0.4×10^{17} at 1000°C. The oxidant on the cathode side was air. It was found that the sum of the interfacial resistances for the fuel cell could be varied more than two orders of magnitude (0.238-33.6 ohm cm^2) by varying the particle size distribution in the electrodes next to the interfaces. The size of the individual interfacial resistances has been determined through the use of a reference electrode in the test system. Measurements indicate that the anode/electrolyte and cathode/electrolyte interfacial resistance are of the same order of magnitude. Linear I-V curves over a wide range of current densities were obtained in recent DC polarization studies on the fuel cells. This indicates that kinetic effects are not significant. Cell tests show that diffusional effects in the electrodes are unimportant as long as their porosity is greater than 10%.

45164 (CONF-861008—Absts., pp 60-63) **Stress and fracture behavior of monolithic fuel cell tapes.** Majumdar, S. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The design of a solid oxide monolithic fuel cell employs thin ceramic components in a honeycomb structure. The technical challenge is to fabricate a ceramic honeycomb from repeating thin layers of four components - anode, electrolyte, cathode, and interconnection under the same condition. The cathode consists of a porous layer of lanthanum manganite, the electrolyte consists of a dense layer of yittria stabilized (fully) zirconia, the anode consists of a porous layer of fully stabilized zirconia containing nickel (NiO in the green state), and the interconnection consists of a dense layer of lanthanum chromite. During sintering of individual layers the total linear shrinkage strains are approximately equal (30%). However, when three or more layers are fabricated as a composite, the total shrinkage strain during sintering is found to be considerably less (20-25%). On closer examination, the shrinkage strain history of the interconnection was found to be significantly different from that of the rest. Similarly, although the coefficients of thermal expansion of the cathode and the electrolyte are closely matched, the anode containing NiO has a slightly higher coefficient of thermal expansion, depending on the NiO content. The present study was undertaken to analyze the stress and creep behaviors of a three-layer tape due to differential shrinkage strain rates during sintering, and the fracture behavior of a three-layer tape due to thermal

stresses generated during cooldown after sintering. Results are discussed.

45165 (CONF-861008—Absts., pp 64-67) **Tape casting high-density electrolyte for solid oxide fuel cells.** McPheeters, C.C.; Claar, T.D. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Yttria-stabilized zirconia (YSZ) has many applications in high-temperature electrochemistry because of its relatively high oxygen-ion conductivity, good stability, and fabricability. Its use as the oxygen-ion conductor in the monolithic solid-oxide fuel cell depends on its fabricability into high density structures which are very thin yet impermeable to the fuel-cell gases. The objective of this work was to develop a process for fabricating thin, high-density, gas-impermeable YSZ structures. More specifically, the fabrication process must be capable of producing structures on the order of 25 to 100 μm thick with densities greater than 94% of theoretical density, firing shrinkage as low as possible, and room-temperature gas permeabilities less than 10^{-7} cm^2/s. The processes considered for this application included hot rolling, tape casting, and curtain coating. Tape casting was selected on the bases of its advanced state of development and extensive use in other technical areas such as the electronic industry. and its relative simplicity.

45166 (CONF-861008—Absts., pp 68-71) **Interconnection development for monolithic solid oxide fuel cells.** Flandermeyer, B.K.; Dusek, J.T.; Blackburn, P.E.; Dees, D.W.; McPheeters, C.C.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The development of an interconnection layer for the monolithic solid oxide fuel cell (MSOFC) has posed a significant materials development challenge because of the particularly demanding set of electrical, mechanical, and chemical requirements that this material must meet. Previous researchers had identified $LaCrO_3$ acceptor doped with Mg or Sr as a material that would satisfy these conditions except for the fact that it like all Cr oxides, will not sinter to high densities in air. The challenge with these materials is that the predominant method of mass transport during firing is an evaporation-condensation mechanism which leads to coarsening of the original particles without densification. To obtain high densities, it has been found necessary to fire $LaCrO_3$ to temperatures in excess of 1650°C in a hydrogen atmosphere. However, these conditions are unacceptable for fabrication of the other cell components. Given the favorable properties of $LaCrO_3$ (thermal expansion characteristics, electrical conductivity, and chemical stability under reduction), efforts were concentrated on developing some method of sintering it at < 1600°C in a relatively oxidizing atmosphere (P/sub O_2/ $> 10^{-5}$ atm) rather than developing a new material. Initial results are described.

45167 (CONF-861008—Absts., pp 72-75) **Electrode development for monolithic fuel cells.** Easler, T.E.; Flandermeyer, B.K.; Claar, T.D.; Busch, D.E.; Fousek, R.J.; Picciolo, J.J.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The methodology for producing electrodes for monolithic solid oxide fuel cells has been developed. Ceramic powder particle size distributions and solvent/binder systems have been tailored to yield the desired electrode porosity levels (20-50%), while matching the firing shrinkages of other cell components. Electrodes have been fabricated with thicknesses of 25-125 μm. Careful control of the stoichiometry and powder characteristics of the cathode material (strontium-doped lanthanum manganite) is necessary for the production of acceptable layers. In the two-phase nickel/zirconia anode, the nickel content is a key variable. Lower nickel contents reduce the thermal expansion mismatch among the cell components; however, the anode conductivity becomes insufficient at nickel contents below about 35 vol. %. Both cathode and anode development are described.

45168 (CONF-861008—Absts., pp 76-79) **Experimental investigation of resistivity, thermal expansion, and oxygen permeation of lanthanum chromite films similar to those in the Westinghouse solid oxide fuel cell.** Ruka, R.J.; Sinharoy, S. (Westinghouse R & D Center, Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The design of the Westinghouse solid oxide electrolyte fuel cell incorporates an interconnection layer of magnesium-doped lanthanum chromite made by the electrochemical vapor deposition technique (EVD). Measurements of properties of this layer, such as thermal expansion, electrical resistivity, stability to oxygen loss at high temperatures and oxygen permeability are difficult to measure when the film is incorporated in the cell due to interference of other cell components. To avoid such interference the authors have grown by EVD, similar lanthanum chromite layers on a porous calcia-stabilized support tube. These layers were used either directly for oxygen permeation experiments, or the layer was stripped off to give a free standing layer for thermal expansion and electrical resistivity measurements. The electrical resistivity of a thin layer of $LaCr_{.98}Mg$/sub .012/O_3 was measured and analyzed in terms of a solid state defect model. The resistivity values of the (EVD) layer in the temperature range of 800 to 1100°C and oxygen partial pressure range of 0.2 to about 1×10^{-18} atm were found to vary between 0.5 to 1.55 ohm-cm. The resistivity values of this oxide and several bulk lanthanum chromite samples doped with Mg, Ca and Sr are shown as a function of temperature.

45169 (CONF-861008—Absts., pp 80-83) **Fuel cell production process control and qualification of finished cells.** Bratton, R.J.; Reichner, P.; Montgomery, L.W. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Qualifying the processes by which solid oxide fuel cells are produced is an important objective of the Westinghouse-Department of Energy Solid Oxide Fuel Cell (SOFC) Power Generation System project. Reaching this objective requires, among other process control actions, that both product requirements and their measurements of compliance (quality measures) be established. At the present time SOFC technology is still emerging from the research phase of its existence, and consequently these requirements and quality measures need as much development as the processes themselves. To accelerate that development, a set of tentative product requirements and quality measures were developed along with the evolution of the processes employed to produce 324 cells for the first 5 kW generator produced on the project. Thus this first production experience provides the framework to define the process limits and refine both the process and product requirements accordingly. This paper discusses fuel cell configuration and production methods, general quality assurance practices, and cell production process quality measures.

45170 (CONF-861008—Absts., pp 84-87) **Zirconia fuel cell power system planar stack development.** Hsu, M. Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

For practical power generation or cogeneration applications, the zirconia fuel cell systems are required to be compact in assembly, competitive in cost, and capable of handling high electrical and thermal energies. To meet these criteria, a planar cell stack design utilizing a composite structure technique has been under development. The methods of fabrication, stack assembly and power system scale-up have been established. After describing the planar cell stack, the paper summarizes the results from a series of tests on a single cell as well as a multiple cell stack. Further development activities are discussed.

45171 (CONF-861008—Absts., pp 88-91) **Effect of S-poisoning on the anodic oxidation of hydrogen in a SOFC.** Ong, B.G.; Mason, D.M. (Stanford Univ., CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Performance loss in the anodic oxidation of hydrocarbons caused by the presence of H_2S, even at a few ppm level, is a major problem for low- and medium-temperature fuel cells using platinum or nickel as electrodes since H_2S is known to chemisorb very strongly on these metals. In this study, the effect of H_2S chemisorption on the anodic oxidation of H_2 in a yttria-stabilized zirconia (YSZ) fuel cell is being investigated. The electrolyte is 10 mole % YSZ in the form of discs 25 mm in diameter and 2 mm thick. Porous electrodes of gold, platinum and nickel are made by suitably painting inks of these metals on the electrolyte surfaces. The inks are supplied by Engelhard Industries. The fuels used in this study are pure H_2 as well as hydrogen gas containing 69 ppm H_2S. The temperature range studied was from 750°C to 900°C. The reactor is shown schematically and details on construction and experimental conditions have been previously described. To avoid contamination by H_2S of the pure H_2 influx stream, separate feed-lines including the alumina feed-tubes were used for the pure H_2 gas and the H_2S/H_2 mixture. Results are given and discussed.

45172 (CONF-861008—Absts., pp 92-95) **Study on performance of air cooled PAFC.** Sakai, T.; Furukawa, N.; Murakami, S.; Nishioka, M.; Itoh, Y. (Sanyo Electric Co., Ltd. Research Center, Osaka (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Sanyo Electric Company has been developing the air cooled PAFC technologies. In 1984, 50kw air cooled PAFC system (type 2) was developed and tested by the actual load. The verification test of on-site 200kw air cooled PAFC system is planned in cooperation with Tokyo Electric Power Company. For the commercialization, the certification of the lifetime is one of the most important factors. The target of the PAFC lifetime is 40,000 hrs, and now its test is continued. This cell has the acid in the thin porous matrix. The amount of the acid is so little that acid management such as acid-adding is important for achieving the high performance and high durability. The paper describes cell construction and acid management and gives results to date.

45173 (CONF-861008—Absts., pp 96-99) **First heavy-duty qualification of a kW-size PAFC stack system in Italy.** Ascoli, A.; Redaelli, G. (CISE S.p.A., Milano (Italy)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

An ERC-made, air-cooled 2.5 kW PAFC stack, equipped with methanol reformer and dc-ac inverter, has been in operation for over 3 years in Segrate (Lombardy, Italy), undergoing hundreds of start-ups and shut-downs. Maintenance operations of the reformer and of the stack were optimized to adjust them to the humid climate of the Lombard Region and to severely intermittent use of the system. Steady-state and transient electric characteristics of the stack were widely studied. The efficiency of the catalytic beds through time was followed checking the chemical composition of the reformer output by both gas chromatographic sampling and on-line I.R. monitoring of CO concentration. Repetition of the electric characteristics of the stack and of the entire system at regular time intervals gives one a useful insight into the behavior of this fuel-to-electricity energy converter through its life.

45174 (CONF-861008—Absts., pp 100-104) **Recommendations for commercial onsite fuel cell grid-interconnect requirements.** Londos, T.; Knable, S.; Houts, E. (Science Applications International Corp., La Jolla, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

A program demonstrating experimental 40 kW fuel cell power plants in onsite applications is underway throughout the US. The power plants were originally designed to operate independent of the utility grid. The requirement for a grid-connected operating mode was added subsequent to the design and testing of the basic power plant. To accomplish this, a Grid-Connect Unit (GCU) was added to interface the grid-independent power plant to the utility grid. Twenty-eight of the 32 utility participants chose to operate 29 fuel cell power plants in the grid-connect mode. To resolve technical issues identified during the field test and assist in the development of future grid-connect features, a Grid-Connect Technical Committee comprised of utility participants was established to review the field test experience and establish grid-interface requirements for future power plants. The objectives of the Committee were to: review and summarize the 40 kW field test experiences related to grid-interconnections; outline and coordinate additional testing or grid monitoring activities; and review and define interconnect and other requirements for a commercial onsite fuel cell power plant. The Grid-Connect Technical Committee was divided into three Subcommittees to review Protection Issues, Electrical Engineering Issues, and Utility Grid-Interconnect Standards. These are discussed.

45175 (CONF-861008—Absts., pp 106-109) **Assessment of fuel cell applications for remote Air Force sites in Alaska.** Taylor, R.W.; Londos, T.C.; Khazra, M. (Science Applications International Corp., La Jolla, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

During 1984 and 1985, remote radar sites in Alaska were undergoing transition from Long Range Radar Stations (LRRS) built in the early 1950s to the Minimally Attended Radar (MAR) facilities which incorporate system consolidation and modernization using less manpower, less energy and having reduced operational requirements. The thermal and electric energy usage of the remote sites was obtained, summarized and analyzed for 1984 and 1985. The analysis includes comparisons of fuel consumption electricity production, operation parameters, costs and degree days. The data for the LRRS consist of gross monthly oil consumption and corresponding degree days. The annual total kWh usage and Btus consumed were also obtained. Data from the MAR facilities consists of total monthly oil consumption, degree days and kWhs generated. The information obtained from a data acquisition system installed at Fort Yukon will be used to determine the technical and economic feasibility of using onsite fuel cell power plants to meet the energy needs of the MAR facilities in place of diesel engines. An economic model was developed to evaluate the life cycle costs of remote site energy systems. It was developed specifically to analyze diesel engine systems and fuel cell power plants. The model was exercised to prove its validity with actual data from the remote site systems.

45176 (CONF-861008—Absts., pp 110-113) **Effect of operating conditions on performance of high-pressure type PAFC.** Tsutsumi, Y.; Sone, I.; Nanba, Y. (Hitachi Research Lab., Ibaraki-ken (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

In 1985, Hitachi Ltd. began construction of a 1 MW high pressure and high temperature type demonstration plant for concentrated power generation in cooperation with NEDO, Chubu-Electric Corp. and Toshiba Corp. Prior to the plant operation various simulation tests of operating conditions were performed to examine the stabilities of the cell performance using 100 cm^2 5-cell stacks. This report summarizes results of these efforts. The paper discusses the effects of steam concentration, air deficiency, and fuel deficiency.

45177 (CONF-861008—Absts., pp 114-117) **Dynamic response of fuel cell power plant to load reference.** Kurosawa, K.; Tanaka, H.; Makabe, T.; Nagata, Y.; Akiyama, K.; Matsumoto, Y. (Tokyo Electric Power Co., Inc. (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Tokyo Electric Power Co., Inc. and Toshiba Corporation developed a dynamic simulator for a class of fuel cell power plant (FCPP) of commercial scale. The simulator is used for the study of dynamic characteristics and controllabilities of FCPP. This report briefly describes the simulator and presents some results obtained by the simulation.

45178 (CONF-861008—Absts., pp 119-122) **Electric utility phosphoric acid fuel cell technology development.** Schiller, T.G.; Johnson, W.H. (International Fuel Cells Corp., South Windsor, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract AC21-83FE60338.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

International Fuel Cells Corporation is conducting a number of component technology programs for electric utility phosphoric acid fuel cell power plant development. Materials and manufactur-

ing processes have been verified in three 10-ft², 28-cell stacks. Components for the 10-ft², 469-cell stack have been manufactured and assembly will be started shortly. The stack will be tested in a semi-automated test facility for up to 4500 hours. A full-scale single-tube reformer utilizing a low pressure drop catalyst was evaluated for a total of 396 hours of testing with both natural gas and naphtha, with the objective of significantly increasing fuel throughput. The same low pressure drop catalyst was evaluated for tolerance to carbon formation. Over a range of specific fuel flows (W/A) of 1.0 to 3.5 lb fuel/hr-ft² at 125 psig, no carbon formation was observed. EPRI has sponsored construction of the reformer burner test facility. This facility will test commercial burners sized up to the equivalent heat release of 2 MW. A 2-MW power switching pole for a two-bridge inverter system was tested to its full rated 3000 Vdc. Dynamic operating parameters were in agreement with analytical predictions. A full size set of advanced inverter controls for a two-bridge inverter was successfully tested at design and off-design conditions on IFC's two-bridge inverter model. In preparation for the design and construction of an advanced multimegawatt inverter bridge, a semiconductor manufacturer's survey is currently being conducted. Definition of applications software requirements for an 11-MW power plant were generated.

45179 (CONF-861008—Absts., pp 123-126) **Air cooled stack development status of Westinghouse phosphoric acid fuel cell program.** Wright, M.K. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Westinghouse Phosphoric Acid Fuel Cell Program key objective is to commercialize the technology in the 1990's as a world class product for Utility power plant applications. The Corporation has been developing the PAFC technology for over a decade. In 1980, the Advanced Energy Systems Division began an aggressive program for the application of this air cooled technology for power generation to utility (all electric) and industrial (cogeneration) needs. The technology development is sufficiently in hand such that large stack demonstrations are proceeding. The program performance goal of 690 mV per cell at beginning-of-life has been exceeded by 10 mV. The program goal for performance loss with time of 8 mV/1000 hours or less has yet to be fully demonstrated in long term testing. These goals are for rated conditions of 190°C, 70 psia, 267 mA/cm², with air to the cathode at 50% oxygen utilization and simulated reformate fuel (75% H_2, 24% CO_2, 1% CO) to the anode at 83% hydrogen utilization. The technology is sufficiently in hand to proceed with large stack and module development as required for the 1.5 MW Pilot Power Plant demonstration.

45180 (CONF-861008—Absts., pp 127-130) **Construction of dispersed type 1 MW PAFC pilot plant.** Itoh, N.; Itoh, M.; Tada, M.; Hijikata, A.; Kishida, K.; Anahara, R.; Suzuki, K. (New Energy Development Organization, Tokyo (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Mitsubishi Electric Corporation, Fuji Electric Co., Ltd. and Fuji Electric Corporate Research and Development, Ltd. constructed the 1 MW phosphoric acid fuel cell power plant located in Sakaiko thermal power station. Demonstration operation test is scheduled to start in December, 1986. The design target of the pilot plant and the construction schedule are shown. The paper outlines the plant layout and gives details about the following subsystems fuel cell stacks, reformer, and control system. Testing of components is briefly discussed.

45181 (CONF-861008—Absts., pp 131-134) **Outline of PAC test for 1 MW PAFC pilot plant, high temp., high pressure type.** Ito, M.; Hanawa, M.; Ishihara, M.; Yoshida, H.; Hyuga, S.; Akimaru, S.; Yamaguchi, A. (New Energy Development Organization, Tokyo (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Main items of PAC test are plant pressurized test, air processing subsystem test, fuel cell cooling water subsystem test, fuel processing subsystem test and plant overall test using dummy cell stacks. The paper gives some results from the air processing and fuel processing tests. The test of Air Processing Subsystem (APS) consists of the following four major items: (1) Air Starting Test - verification of turbine compressor start control and checking out air purge in auxiliary combustor; (2) Auxiliary Combustor Burner Ignition Test - verification of pilot and main burner ignition failure routine and pilot and main burner ignition; (3) Acceleration Test - verification of turbine compressor acceleration control; and (4) APS Test - verification of plant base pressure control, confirmation of turbine compressor characteristics, confirmation of APS general characteristics combined with the fuel processing subsystem, and auxiliary combustor burner fuel transition test from natural gas to process gas. The test of Fuel Processing Subsystem (FPS) consists of the following five major items: (1) Nitrogen Recirculation Test - verification of start recycle blower control and checking out air purge in reformer combustion chamber; (2) Reformer Burner Ignition Test - verification of Pilot burner ignition failure routine, pilot burner ignition, verification of main burner ignition failure routine and main burner ignition; (3) Heat-up Test - heating up the fuel processing subsystem with start recycle blower and steam-in test; (4) Low Temperature Shift Converter (LTSC) Catalyst Activation - removal of oxide film on catalysts with hydrogen; (5) Reforming Test - confirmation of reformer characteristics, activation of high temperature shift converter (HTSC) catalyst, confirmation of general characteristics combined with the reformer, HTSC and LTSC, and reformer burner fuel transition test from natural gas to process gas.

45182 (CONF-861008—Absts., pp 135-139) **Fuel processing system development and reformer test results.** Summers, W.A.; Parker, W.G.; Rastler, D.M.; Udengaard, N.R.; Christiansen, L.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Fuel processing systems for phosphoric acid fuel cell power plant applications require design changes and process improvements relative to conventional hydrogen plants. Haldor Topsoe has developed a high-efficiency steam reformer for the fuel cell power plant application. The reactor uses a patented principle with combination of co-current and countercurrent heat exchange between the process gas and the flue gas in order to maximize the thermal efficiency and at the same time taking the limitations imposed by the construction materials into consideration. One full scale module of the heat exchange reformer has been designed, constructed and erected at the pilot facilities of Haldor Topsoe, Inc., The test program for 1986 includes commissioning and startup, runs at constant load, cycling tests, and mechanical inspections. Results are given and discussed.

45183 (CONF-861008—Absts., pp 140-142) **Molten carbonate fuel cell technology development.** Reiser, C.A.; Schroll, C.R.; Smith, M.J. (International Fuel Cells, South Windsor, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract AC21-79ET15440.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Recent activities in Molten Carbonate Fuel Cell (MCFC) technology development at IFC have centered on two related issues: (1) a system update for coal gasifier applications to account for the use of NiO cathodes, and (2) cell area scale-up to 8-ft² to be demonstrated in an upcoming short stack test. Both of these are discussed.

45184 (CONF-861008—Absts., pp 143-146) **Direct fuel cell development.** Paetsch, L.; Patel, P.S.; Maru, H.C.; Baker, B.S. (Energy Research Corp., Danbury, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Development of the direct molten carbonate fuel cell (DFC) has recently emphasized both single cell component improvements and multi-cell testing of these improvements. Individual component specifications and goals are derived from considerations of system design and application requirements. The performance and endurance of stackable components have been characterized in bench-scale cells and 2 to 10-cell stacks. Operability of DFC was con-

firmed in a 10-cell stack with 1 ft^2 size components. Results of these studies are discussed below.

45185 (CONF-861008—Absts., pp 147-150) **Status of MCFC development at Toshiba.** Murata, K.; Shirogami, T.; Ogimoto, K.; Sakamoto, Y. (Toshiba R & D Center, Kawasaki (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The objectives of the project during Phase-1 are to establish basic cell and stack technology and to conduct the 10kW class stack demo-operation in 1986 Japanese fiscal year. Full stack development work is planned to follow the Phase-1. The program at Toshiba is to develop paste type electrolyte MCFC, where the paste type is denoted as the electrolyte layer made of the pre-mixed powders of alkaline carbonate and electrolyte support. Toshiba has developed a new paste-type electrolyte fabrication process, where the mixture of alkaline carbonate, $LiAlO_2$ support, crack arresting ceramic fibers and polyethylene binder are molded at low pressure (100 kg/cm^2) and low temperature (140°C). Though the electrolyte layer is not as impervious to gaseous reactants as hot pressed ones even after the binder burn out, combination with the dual porosity anode, which works as bubble pressure barrier, provides a good performance cell. For the 10 kW stack assembling, 50 cm square cell components were developed. Several short stacks utilizing 50 cm square cells (1600 cm^2 effective reaction area) were assembled, and the applicability of the cell components and the stack configuration were evaluated. The paper describes these test and gives some results. Endurance improvements made to the anode bubble pressure barrier layer, thermal cyclability, and manifold sealing are also discussed.

45186 (CONF-861008—Absts., pp 151-154) **Overview of the Dutch MCFC program.** Pietersz, S. (PEO, Utrecht (Netherlands)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

In December 1985 the Dutch government approved a PEO-proposal for a three year MCFC development program and made available to PEO 10 million Dutch guilders (appr. US $ 4 million) for the execution of the program. The objectives of the program are: to build up the level of knowledge on MCFC technology in order to be able to contribute to international developments; and to create possibilities for a Dutch industrial product-development of MCFC technology. The main reasons for the Dutch government to invest in a MCFC development program were the following: a potential interesting market in the Netherlands and Europe; high efficiency and low pollution of MCFC-systems; suitability of natural gas as fuel; available R & D capabilities; spin-off for other new technology areas (e.g. new materials). The results from a Dutch market study show that the estimated market potential demands very much on system investment costs. Since these costs are still a matter of speculations, it is unwise to state firm future market potential figures. A brief description is given of the main activities under this program: development of components; design, construction, and testing of a pilot cell; and design, construction, and testing of a pilot stack (1 kW).

45187 (CONF-861008—Absts., pp 155-158) **Development of molten carbonate fuel cell technology.** Hirata, I.; Murahashi, T.; Sato, K.; Urushibata, H.; Matsumura, M. (Mitsubishi Electric Corp., Amagasaki (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Mitsubishi electric corporation has been performing R & D of molten carbonate fuel cell technology as the highest priority program. Emphasis during past year was focused on the estimation of electrolyte loss during long period operation and the development of stack leading to scale up of components. This paper reports on the electrolyte analysis of single cell and stack.

45188 (CONF-861008—Absts., pp 159-162) **Molten carbonate fuel cell technology development at Fuji.** Koseki, K.; Nakanishi, T.; Kobayashi, K. (Fuji Electric Corporate Research and Development Ltd., Yokosuka (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Studies have been concentrated on the development of components such as electrolyte plates, electrodes, and cell stack configurations. In 1985, a 30-cell stack with 200 cm^2 electrodes was built and tested at CRIEPI. In parallel, the company has been developing new electrolyte matrix fabrication methods under the contract with NEDO since 1984. In 1986, a 2900 cm^2 size single cell using the new matrix was built. Fuji is now promoting the construction of a 2500 cm^2 size 24-cell stack using the new matrices, which will be tested by the end of this fiscal year. This paper gives details of the stock configuration, the electrode, and electrolyte matrix.

45189 (CONF-861008—Absts., pp 163-167) **Progress on molten carbonate fuel cell alternative cathodes.** Smith, J.L.; Kucera, G.H.; Minh, N.Q. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

$LiFeO_2$ and Li_2MnO_3 in doped forms appear to meet the requirements for cathode materials. These were chosen from a larger number of compounds which were identified as being thermodynamically stable in the cathode environment. The undoped forms were extensively tested and meet the requirements of low solubility, nonmigration, and stability. Doping can be used to enhance the conductivity of these two materials. Their conductivities are very dependent on stoichiometry, and therefore on environment. In typical cell environments, the undoped materials have resistivities of from a few hundred to about one thousand ohm-centimeters resistivity. The precise requirement for cathode use has been ill defined due to the complex nature and incomplete understanding of the cathode's operation. A cathode model developed by Physical Sciences Incorporated was used to examine predicted performance of various cathodes, with microstructure and electronic conductivity of the material as parameters. The conclusion is that material resistivity of as high as ~ 20 Omega-cm under operating conditions may be acceptable with proper microstructure. Resistivities of ~10 Omega-cm can be achieved with doped materials under realistic cell conditions. The emphasis has therefore shifted toward fabricating appropriate microstructures with doped materials, then testing them in cells. The fabrication of the cathode structures are discussed.

45190 (CONF-861008—Absts., pp 168-171) **Oxide dispersion strengthened (ODS) anode.** Erickson, D.S.; Ong, E.T.; Donado, R. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

State-of-the-art molten carbonate fuel cell (MCFC) anodes are porous plaques prepared by sintering a physical mixture of metallic nickel and a variety of stabilizing additives in a reducing atmosphere at about 1000°C. The anode provides reaction sites for the electrochemical oxidation of hydrogen in the fuel, which is enhanced by increased surface area, good electronic conductivity, and sufficient wetting by the carbonate electrolyte. To maintain these characteristics, the pore structure and the wetting characteristics of the anode are important and, since the fuel cell will be required to endure 40,000 hours of operation, the stability of these properties must be assured. In consideration of stack designs, several shortcomings of the anode began to surface, among the most important were cost, creep, and morphological stability. As a result, each developer and technology supporting group included experimental efforts in their programs to improve and/or eliminate these shortcomings. These efforts are described.

45191 (CONF-861008—Absts., pp 172-176) **Analysis of the decay of an isothermal MCFC at 893 K.** Giordano, N.; Freni, S.; Quagliata, R.; Cavallaro, S.; Carbonaro, P. (Istituto CNR-TAE Pistunina, Messina (Italy)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Preliminary results obtained at 893 K on a single MCFC recently installed in this Institute are reported. The fully automated test facility, which uses state of the art components supplied by the Institute of Gas Technology (IGT, Chicago), has been operated for

more than two years under various conditions. The objective of these tests was to establish the performance and the endurance at lower than baseline T (923 K). It was reasoned that, since the most important rate processes affecting component's durability and cell's performance are marked by high activation energies, a better understanding of phenomena so occurring would constitute a reference for a preliminary evaluation of the attractiveness and limits of lower operating temperatures. Results obtained from a series of runs at 893 K are reported including post-mortem analyses of components after these tests, the longest of which lasted ca. 4450 h.

45192 (CONF-861008—Absts., pp 177-181) **Modeling of H_2S effects on the performance of molten carbonate fuel cells.** Wilemski, G. (Physical Sciences Inc., Andover, MA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract AC21-83MC20212.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

A model has been developed to predict the performance of a molten carbonate fuel cell (MCFC) operating on fuel contaminated by low levels (1-10 ppm) of H_2S. The calculation of voltage losses is based on a poisoning mechanism drawn from experimental studies at the Institute of Gas Technology. An existing MCFC performance model was modified to include the effects of this mechanism on cell polarization. The performance model was also modified to account for the effects of SO_2 crossover from the cathode to the anode occurring when spent, H_2S-containing fuel is burned and added to the cathode stream for CO_2 makeup. For this application of the fuel cell performance model, a flooded agglomerate model and a heterogeneous film model were used, respectively, for the cathode and anode. These two models represent reasonably well the NiO cathodes and 90/10 Ni/Cr anodes used in IGT cells. Only counterflow geometry was considered in order to simplify the interpretation of results as well as the model development and validation. Results are discussed.

45193 (CONF-861008—Absts., pp 182-185) **Status of molten carbonate fuel cell development at Hitachi.** Ohtsuka, K.; Sohma, A.; Hisano, K.; Hishinuma, Y. (Hitachi Works, Ltd., Ibaraki-ken (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Large sized (3000 cm^2 class) electrolyte plates made by the tape casting method have been produced successfully, and single cell and 3-cell stack tests with 3600 cm^2 components, and 15-cell stack and 30-cell stack tests with 900 cm^2 components were achieved using the 10 kW class test facility. The paper describes the development of the electrode, electrolyte plate, and the separator and gives results from the cell and stack performance tests.

45194 (CONF-861008—Absts., pp 186-189) **Low cost methanol-phosphoric acid fuel cell power plants.** Chi, C.; Fan, J.; Richards, L.; Abens, S. (Energy Research Corp., Danbury, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

ERC is developing low-cost methanol fuel cell power plants for commercial applications in the 2-10 kW range. Their main objectives are: (1) Compact size, (2) Cost reduction, (3) Improved reliability, (4) Fully automatic operation and control. Design and specifications are given for a 7 kW DC prototype power plant with an on-board microprocessor.

45195 (CONF-861008—Absts., pp 190-193) **Development of small capacity phosphoric acid fuel cell power system at Fuji Electric.** Harashima, K.; Hirota, T.; Tsuji, Y. (Fuji Electric Corporate Research and Development Ltd., Yokosuka (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Fuji started the research and development of methanol reformer in 1984. They constructed 3-7 kW methanol reformer and evaluated their performances within one year. For the present, Fuji is investigating the problems which will occur on the practical use, such as operability, maintainability and performance under the actual conditions. They also intend to enter into field testing with potential customers and to accumulate the real operational experience under various conditions. This paper describes the 3 kW power systems and the 5k VA/4 kW power systems.

45196 (CONF-861008—Absts., pp 194) **Engelhard technology update.** Kaufman, A. (Engelhard Corp., Edison, NJ (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Engelhard phosphoric acid fuel cell stack technology - directed toward multi-kilowatt, atmospheric-pressure applications - continues to be based on the following key features: single-phase liquid cooling, cooling plates and bipolar plates comprising commercial graphite, electrolyte-matrix configuration that incorporates an acid-transport layer, continuous acid-replenishment system, and in-house developed catalysts. Recent emphasis in the technology development program has involved implementation of thinner graphite elements, selection of the most attractive graphite plate bonding resin, simplification of the acid-replenishment system configuration, and qualification of an improved acid-transport layer structure. The key test vehicles for confirmation of technology improvements have been stacks of the 4 kW size. These stacks typically consist of 24 cells of the 13 inch x 23 inch size; the active area is 1.75 square feet. Improvements are currently being implemented in a 25 kW stack. This stack will reflect technology features qualified through the early part of 1986. Stack testing will be carried out in conjunction with a methanol processing sub-system during the last quarter of 1986. A natural gas processing sub-system, currently under development, will then be integrated with the 25 kW stack early in 1987.

45197 (CONF-861008—Absts., pp 195-198) **Construction and testing of PAFC demonstration power plant.** Okamoto, T.; Funahashi, N.; Saito, R.; Sumi, S. (Tokyo Electric Power Co., Inc. (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Tokyo Electric Power Co., Inc. (TEPCO) is investigating a small 200 kW class air-cooled type PAFC plant under the joint work with Sanyo Electric Co., Ltd. The plant is scheduled to be installed at the site of the Shin-Tokyo Thermal Power Station located at Toyosu, Tokyo and be tested from next April for about 1.5 years. The paper outlines the demonstration program and the system being tested.

45198 (CONF-861008—Absts., pp 199-202) **On-site fuel cell technology and system progress.** Scheffler, G.W.; Kemp, F.S.; Acevedo, J.C. (International Fuel Cells Corp., South Windsor, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The purpose of this On-Site Fuel Cell Technology development Program is to develop the technology base for a 200-kW power plant that will meet requirements for on-site electric power generation. Present activities are focused on building and testing a 200-kW Verification Test Article (VTA) and transistor inverter. The VTA is a dc system test rig which includes: (1) a Fuel Processing System to convert natural gas fuel into a hydrogen-rich fuel gas mixture, (2) a cell stack to produce dc power from hydrogen and oxygen (in air), (3) a Thermal Management System to reject waste heat and recover water for the fuel processor, and (4) a Water Treatment System to clean the recovered water. The Verification Test Article is scheduled to begin testing in early 1987. Prior to operation of the VTA, key subsystems and controls will be evaluated separately. Progress to date is described.

45199 (CONF-861008—Absts., pp 203-206) **MCFC R and D in the Netherlands.** Joon, K.; van der Molen, S.B.; de Vries, J.E. (Netherlands Energy Research Foundation, Petten). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Based on state-of-the-art know-how to be bought, available relevant capabilities, international cooperation and avoiding redundancy as far as possible, 13 projects have been defined. These cover and strike a balance between fundamental and applied research, development of materials and components as well as manufacturing

techniques, and construction and engineering. The results will be instrumental in establishing a basis for fundamental understanding and in providing industrial partners with commercially interesting technology. This paper details technology transfer of existing knowledge abroad, research in electrochemistry and materials science, development projects to be undertaken, and construction and engineering projects.

45200 (CONF-861008—Absts., pp 207-210) **Cooling characteristics of molten carbonate fuel cell.** Watanabe, K.; Nikai, I.; Tooi, M.; Nakazawa, K.; Hosaka, H.; Tanaka, J. (Ishikawajima-Harima Heavy Industries Co. Ltd. (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Of the three basic methods of flowing fuels and oxidizers in a molten carbonate fuel cell (MCFC), the cross flow, the co-flow, and the counterflow, the first is being used today to the amazement of any heat engineers. This may simply be a custom from an early day of phosphate FC development, which needed no more than steam to control temperature. But, whatever the reason, the situation is not that simple for MCFC. As little is known of cooling characteristics of MCFCs, the authors report the results of simulator tests and calculations they conducted to analyze the FC performances under those three different flow conditions.

45201 (CONF-861008—Absts., pp 211-214) **Modeling of electrolyte migration in the molten carbonate fuel cell stack.** Pigeaud, A.; Wilemski, G.; Rigos, D.; Chamberlin, R. (Energy Research Corp., Danbury, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Electrolyte Management in the MCFC to prevent loss of electrolyte from active cell components has been a concern. Contributing causes are: Vapor Loss - minor and mostly in the anode exit gas as KOH vapor; loss due to Corrosion Reactions - mostly Li-rich scale formation; loss due to Carbonate Creepage and absorption in oxide scales; Electrolyte Migration losses - main concern in a stack situation. Although as stated in a recent paper, it is difficult to eliminate vapor loss from gas fed molten carbonate fuel cells, corrosion and electrolyte creepage can be, and have been, substantially reduced by suitable choices of stainless steel hardware and surface coatings. The mechanisms of Electrolyte Migration are modeled in this paper to understand how best to eliminate their causes by either changing stack geometry, gasket porosity, and/or coatings to modify the electrochemical activity of the hardware surfaces.

45202 (CONF-861008—Absts., pp 215-218) **Development of electrode and electrolyte plate for molten carbonate fuel cell.** Takeuchi, M.; Tamura, K.; Hishinuma, Y.; Ohtsuka, K. (Hitachi, Ltd. (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Research and development of the MCFC at Hitachi has focused on the improvement of cell component properties and performance. This paper describes the materials and fabrication of the cathode, anode, and electrolyte plate. A laboratory scale single cell was fabricated and tested. Performance results are shown.

45203 (CONF-861008—Absts., pp 219-222) **Control of NiO cathode dissolution.** Ong, E.T.; Remick, R.J.; Donado, R. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Although nickel oxide cathodes have been used in single cells for periods in excess of 40,000 hours at atmospheric pressure, cathode dissolution is believed to be a potential problem at elevated pressure operation due to increased CO_2 partial pressure of the oxidant. Cathode dissolution involves transport of the dissolved species into the electrolyte structure where they are reduced and deposited as nickel. This process leads to eventual thinning of the cathode and a possible short-circuiting of the cell by the deposited nickel. Cathode dissolution studies at IGT are being carried out in two separate but parallel programs. The EPRI-sponsored program involves in-cell testing of alternative cathode materials and also the implementation of measures to control the dissolution. The measures under investigation are based upon an understanding of dissolution and transport mechanisms and upon observation of the microstructural changes that take place within the cathode and the precipitation behavior of the nickel within the electrolyte structure itself. On the other hand, the objective of the program sponsored by DOE was to investigate the rate of dissolution and the mechanism of transport of dissolved nickel species from the cathode into the molten electrolyte. Results from both programs are given.

45204 (CONF-861008—Absts., pp 223-227) **IGT's MCFC stack testing program.** Camara, E.H.; Benjamin, T.G.; Petri, R.J. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The latest double phase of IGT's MCFC stack testing program involves firstly the conceptual design and design analysis, identification and resolution of specific stack related issues such as carbonate management and dimensional stability, scale-up of components and fabrication processes including metal forming and joining, assembly and verification testing of stacks, and internal reforming and secondly the design, construction, and shakedown of a molten carbonate fuel cell stack testing facility for verification of designs and advanced components. Both programs are described.

45205 (CONF-861008—Absts., pp 228-229) **Carbon deposition in molten carbonate fuel cells.** Ham, D.O.; Lord, G.W. (Physical Sciences Inc., Andover, MA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract AC21-81MC16242.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Carbon deposits can form on molten carbonate fuel cell (MCFC) anode materials or inlet hardware from the carbon monoxide in the fuel mix. These deposits can block electrode pores, decreasing reactivity, or can completely clog the inlet and block the fuel flow. The usual approach for preventing carbon deposition is to add steam to the fuel. Steam addition requires heat to generate the high temperature steam and reduces cell operating efficiency due to fuel dilution. If one can limit steam addition to the minimum necessary to obtain compositions near the equilibrium carbon formation boundary while maintaining carbon free operation, one can attain an efficiency gain of 2-3% compared with normal operation. The authors have investigated carbon deposition on various MCFC materials to obtain sufficient understanding of this process to guide the choice of conditions for efficient operation. They interpreted their experimental results by comparing them with equilibrium and partial equilibrium calculations of carbon boundaries and species concentrations. In this analysis the Gibb's phase rule specifies that three, and only three, independent reactions can be considered among the five independent components of the system, the fuel species H_2, H_2O, CO, CO_2 and CH_4. No detailed mechanisms are available to guide the choice of reactions, so the authors have chosen the three simplest, global reactions as the complete set. These reactions are: the water-gas shift, methanation, and the Boudouard reaction. Experimental procedures are described and results are discussed.

45206 (CONF-861008—Absts., pp 230-233) **Magnesium oxide based internal reforming catalysts for the direct MCFC.** Giordano, N.; Frusteri, F.; Tsiakaras, P.; Mezzapica, A.; Parmaliana, A. (CNR-TAE Institute, Messina (Italy)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

As direct utilization of methane in the direct molten carbonate fuel cells (DMCFC) is expected to offer higher efficiencies, ever increasing attention has been recently paid to search of catalysts which could offer high activity together with satisfactory thermal and chemical resistance to the severe conditions of the cells. Further, as modeling of DMCF requires reliable kinetic data, the need of extensive experimentation on catalytic activity of candidate catalysts is strengthened. In this work the authors report preliminary results of out-of-the-cell experiments in the steam reforming of CH_4. Kinetic data on some model Ni/MgO and Ni/γ $LiAlO_2$ catalysts are reported under reference conditions approaching extreme GHSV (up to 150.000 h^{-1}) and T lower than the baseline T (923°K). Emphasis is placed on a novel Ni/MgO formulation

which takes advantages of unique characteristics of an as-received commercial MgO support (Ube # 500).

45207 (CONF-861008—Absts., pp 234-238) **Electronic defects in $LiFeO_2$.** Smith, J.L.; Kucera, G.H.; Minh, N.Q.; Moreschi, J.R. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

$LiFeO_2$ is under development as an alternative cathode in molten carbonate fuel cells. It is chemically stable, has low solubility, and does not migrate under fuel cell conditions. In the doped state, $LiFeO_2$ has been produced with resistivities of 10 Omega-cm in realistic cathode gases; under similar conditions, undoped $LiFeO_2$ has a resistivity of ~ 300 Omega-cm. While the doped material appears to be adequate for fuel cell use, further improvement is being pursued. A better understanding of the details of the conduction mechanisms of the material would aid in this endeavor. It is known, from their previous studies, that the resistivity, rho, of undoped $LiFeO_2$ is sensitive to reaction gas conditions. Therefore, it is reasonable to assume that small changes in stoichiometry have occurred. Conductivity is then caused by electronic defects which result from equilibration with the fuel cell cathode environment. With $LiFeO_2$, the problems of dealing with a ternary oxide must be considered. In addition to temperature and oxygen partial pressure (variables relevant for binary oxide studies) another variable, such as the activity of one of the constituent binary oxides, must be specified for complete thermodynamic definition of the system. Because of the working environment of a carbonate fuel cell cathode, the lithia activity is the most reasonable additional specified variable. It is apparent that the lithia activity is a function of electrolyte melt and cover gas compositions. This study seeks to identify the defect structure and nonstoichiometries of undoped $LiFeO_2$ prepared in air and in typical cathode gas using a variety of tests including conductivity, Seebeck, and thermogravimetric measurements in controlled gas environments.

45208 (CONF-861008—Absts., pp 239-243) **Physical and chemical characterization of gamma-lithium aluminate for use in molten carbonate fuel cells.** Fairchild, G.H.; Brown, P.M. (Foote Mineral Co., Exton, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Lithium aluminate, a lithium aluminum oxide having the formula $LiAlO_2$, has found application as an electrolyte support medium in the molten carbonate fuel cells. This compound can be prepared from the calcination of various lithium and alumina sources. Three crystal modifications of $LiAlO_2$ have been characterized: α, β, and γ. Both α and β-$LiAlO_2$ undergo an irreversible transformation to γ-$LiAlO_2$ in the presence of Li_2CO_3/K_2CO_3 (62 mol % Li_2CO_3/38 mol % K_2CO_3) at 650°C and 700°C, respectively. The phase changes are accompanied by a change in particle morphology and a decrease in surface area. From a thermodynamics standpoint, γ-$LiAlO_2$ is the most desirable crystalline form for MCFC applications. Foote Mineral Company has commercialized two γ-$LiAlO_2$ products for specific application in MCFC technology: a high surface area (8-12 m^2/g) and a low surface area (0.5-1.0 m^2/g) product. High-surface area γ-$LiAlO_2$ is used in MCFC matrices primarily for electrolyte retention. Low surface area γ-$LiAlO_2$ can be viewed as a larger particle size inert ceramic material to be added to the electrolyte matrix for strength and crack attenuation. Mixtures of high and low surface area γ-$LiAlO_2$ provide a broader range of particle sizes to allow better packing and forming characteristics. Physical and chemical properties are listed for both lithium aluminates and for various blends.

45209 (CONF-861008—Absts., pp 244-247) **Material studies on molten carbonate fuel cell.** Kodama, T.; Miyazaki, Y.; Tanase, S.; Yanagida, M.; Tanimoto, K.; Kose, S. (Government Industrial Research Institute, Osaka (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Government Industrial Research Institute, Osaka (GIRIO) started studies on cell materials of molten carbonate fuel cell (MCFC) from 1981 in the Moonlight Project. At present, the surveying efforts of electrode and electrolyte matrix materials are continuing, and the physical properties data such as melting point, electric conductivity, vapor pressure etc. are being accumulated for binary or ternary systems of carbonate electrolytes. These activities are briefly described and some recent results are shown in this paper.

45210 (CONF-861008—Absts., pp 248-253) **Development of phosphoric acid fuel cell technology.** Matsumoto, M.; Hijikata, A.; Otaka, Y. (Mitsubishi Electric Corp., Kobe (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Phosphoric acid tends to be driven out of the due positions and to lose the desirable distribution form among the cell constituents during the cell operation. Although all the driving forces of the phosphoric acid to move are not clearly known, the routes are known with their weights of importance. Some routes are via electrode backing substrates. Phosphoric acid, in the form of microstream, flows from the catalyst layers to the separator through the backings. In order to prevent the phosphoric acid stream from occurring, wetproofing treatment of the backing substrate is carried out. In the wet process of manufacturing electrodes, backing substrate is coated with catalyst pastes. Wetproofing of the substrates influences the surface roughness of the catalyst layer in the substrate side and the gas diffusion, and the counter diffusion of water vapor also, with the formation of phosphoric acid film near the electrode surface in the substrate. The authors make clear in this paper, the effects of wetproofing on cell performance.

45211 (CONF-861008—Absts., pp 254) **Hydrogen storage options for fuel cells.** Gross, S. (Boeing Aerospace Co., Seattle, WA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Hydrogen/oxygen fuel cells can be used in a variety of commercial, military, and aerospace applications where the hydrogen must be stored. Chemical storage and storage as hydrides become very attractive for some of these applications. Early efforts to develop hydrides for secondary batteries resulted in a gradual physical deterioration of the hydride material due to volume changes. Modification has been made to the composition of the materials to correct that deficiency. The greatest amount of hydrogen stored in hydrides appears to be with the use of amorphous materials, as opposed to the more common crystalline materials. Up to three weight percent of hydrogen can be stored for operation at room temperature, and even greater amounts are obtainable using high temperature extraction. Chemical storage of hydrogen also has good promise for some applications. Candidate chemicals include VH_2, ZrH_2, ZrNiH, NH_3, $NaBH_4$, and Fe + HCl. Crystalline aluminosilicates, referred to as zeolites, can also store hydrogen by insertion into molecular-scale channels and cavities. Another approach is storage of hydrogen in glass microspheres, typically 5 to 200 microns in diameter with wall thicknesses in the range of 0.25 to 5.0 microns. Hydrogen can be stored at very high pressure, on the order of 800 atmospheres, with a theoretical capacity of 11% by weight. The hydrogen is recovered by heating the spheres to about 225°C, whereupon the hydrogen diffuses out through the walls of the spheres. Still another method is absorption on high surface area activated carbons, typically at liquid nitrogen temperature. Up to 7 wt. % of hydrogen can be stored at 600 psig.

45212 (CONF-861008—Absts., pp 255-262) **Design and economics of large fuel cell power plants.** Minkov, V.; Daniels, E.; Dennis, C.; Krumpelt, M. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

At Argonne National Laboratory the authors recently assessed the economics of fuel cell power plants for 575 MW utility central stations. Initially the authors based their assessment on fuel cell systems taken from the literature. It became apparent that the cost of the initial set of fuel cells plus the replacements represented a large share of the system cost, and in fact made the fuel cell systems more costly than the competing technology. They suspected that the systems had been designed assuming high efficiencies were synonymous with good economics, but no attempts had been made to determine the most economical combination of fuel cells, com-

bustion turbines, and steam turbines. In this extended abstract, the authors discuss two new system designs for phosphoric acid and molten carbonate fuel cells. Both designs were developed cascading the flow of energy through the fuel cells, combustion turbine and steam turbine. By varying the utilization of fuel in the fuel cells and the current density, the distribution of power among the prime movers is being changed, and effects of those changes analyzed.

45213 (CONF-861008—Absts., pp 263-267) **Preliminary design of coal gasifier/phosphoric acid fuel cell power plants on an electronic spreadsheet.** Lu, C. (NASA Lewis Research Center, Cleveland, OH (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The objective of this study is to identify the most promising integrated coal gasifier (CG)/PAFC design and its optimal operating conditions. Many system studies have been conducted separately on both coal gasification with associated contaminant control, and phosphoric acid fuel cells (PAFC) to determine the performance and economics of each. There are very few studies that have combined both systems. A spreadsheet-created process flow sheet simulation model using a personal computer is very user-friendly and has an advantage of interaction, especially during the preliminary system synthesis work. Material and energy balances for each component (unit operation) in the CG/PAFC system are formulated on a spreadsheet. Then a power plant system is synthesized by coordinating and integrating unit operation models. The interactive feature allows the designer to review the calculation, make decisions based on the preliminary results, and quickly correct mistakes or faulty assumptions. The system or single-staged approach is applied in this study. Thermodynamic balances are used to set up algebraic equations, then one can calculate the physical and chemical properties of the streams for one operating conditions, such as the mean temperature and pressure.

45214 (CONF-861008—Absts., pp 268-270) **Performance and corrosion resistant supports for acid fuel cells.** Kush, A.; Yeh, P.; Dhar, H.; Christner, L. (Energy Research Corp., Danbury, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

A review of ERC's experience on alternate catalyst supports for atmospheric and pressurized phosphoric acid fuel cells is presented. Equivalent performance was demonstrated for graphitized and nongraphitized carbon black supports as shown, although the corrosion rates are at least two orders of magnitude different. The most corrosion resistant material tested to-date is a 2700°C heat treated carbon black from Cabot Corporation known as Black Pearls 2000. A comparison of typical corrosion rates is shown. Performance measurements at various potentials and pressures have been performed to assess the effect of changes in corrosion rate. Operation in the range of 700 mV and 850 mV and 1 atm to 120 psia revealed no basic difference in the performance loss behavior even though the carbon catalyst support had very different apparent corrosion rates. A loss in activity was observed for all materials. Apparently there is a loss which is unrelated to diffusion and corrosion resistance of the carbon support. A typical loss behavior is shown.

45215 (CONF-861008—Absts., pp 271-274) **Development of a membrane alkaline fuel cell for caustic concentration in the chlor-alkali industry.** Taylor, E.J.; Gelb, A.; Waterhouse, R. (Physical Sciences Inc., Andover, MA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract FC07-84ID12495.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The objective of the PSI/Department of Energy cooperative agreement is to demonstrate the feasibility of improving the efficiency of the chlorine/caustic soda production process. Due to the magnitude of this industry, efficiency improvements have a significant impact on the nation's energy usage. In the PSI system, the dilute sodium hydroxide (30 wt%) from the membrane electrolysis cell is split and goes into the alkaline fuel cell which contains a cation selective membrane separating the anode and cathode chambers. By-product hydrogen produced in the membrane electrolysis cell is used as fuel at the anode of the fuel cell and oxygen from air is the oxidant. Due to the presence of the cation selective membrane, the electrochemical reactions concentrate the caustic soda in the catholyte and dilute the caustic soda in the anolyte. The sodium hydroxide catholyte leaves the alkaline fuel cell at 50 wt% and the anolyte leaves at 21 wt%. The anolyte is recycled back to the cathode side of the electrolysis cell. Thus the alkaline fuel cell serves two functions: (1) to concentrate caustic and (2) to generate electrical power. The most significant advantage of the PSI system over current technologies is that caustic concentration is carried out in the fuel cell without any need for external energy input. Additionally, the alkaline fuel cell provides an efficient way to use the by-product hydrogen to cogenerate electricity. To date, the authors have demonstrated the performance of an advanced cation exchange membrane in the electrolyte environment relevant to the PSI system. They are currently evaluating electrocatalyst materials in the catholyte environment and, in future research efforts, they will evaluate membrane and electrode performance stability. Finally, the authors will demonstrate the system performance in a bench scale (60 cm^2) process developing unit.

45216 (CONF-861008—Absts., pp 275-278) **Development of polymer fuel cells for Canadian Department of National Defence.** Watkins, D.S.; Dircks, K.W.; Epp, D.G.; McLeod, D.D. (Ballard Technologies Corp., Vancouver, British Columbia (Canada)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Ballard Technologies Corporation (BTC) is developing solid polymer electrolyte fuel cell or Polymer fuel Cell (PFC) technology in conjunction with the Canadian Department of National Defense. During Phase I (Technology Acquisition), BTC acquired state-of-the-art PFC technology for Canada. The technology was demonstrated in single cells and stacks with power outputs up to 280 W. The objective of Phase II (April 86 to March 87) is to significantly advance PFC technology through the development of a high current density reformate/air stack. High current density performance/life testing on H_2/air, reformate/air and, at low catalyst loading on H_2/air will be performed in single cells. Testing of BTC Membranes Inc. low cost PFC membranes in addition to promising membranes from other companies will also be done. This paper briefly describes the results to date.

45217 (CONF-861008—Absts., pp 279-283) **Fuel cells as a long range highway vehicle propulsion alternative.** Rentz, R.L.; Hagey, G.L.; Kirk, R.S. (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

At least two recent assessments have attempted to methodically analyze fuel cells for automotive highway transportation. The Los Alamos National Laboratory (LANL) has analyzed three developmental fuel cell technologies for automotive highway vehicle applications using a consistent set of ground rules and a vehicle simulation computer program. JPL, in a broader assessment of advanced electric and hybrid vehicles, used a similar technique to examine the near-term potential of fuel cell technology. These previous study efforts are significant in identifying the viable fuel cell candidates for transportation and the areas upon which to focus research but without specific quantification of the needed achievements. Recommendations are made for a study methodology for a comprehensive systems analysis of fuel cells for automotive highway transportation which analyzes and documents in one study the various applications, the various candidates, where technology actually stands, what technology capability would be required, as well as providing a consistent data base for the long-term.

45218 (CONF-861008—Absts., pp 284-287) **Life prediction of fuel cell reformer tube by creep-fatigue analysis.** Yokomaku, T.; Saori, M.; Okuda, T.; Nohara, A.; Tai, H.; Imoto, Y. (Kobe Steel Ltd. (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The steam reformer in fuel-cell application is required to be compact in size and fast in response to the frequent startup/shutdown cycles. As a result, reformer tubes are subjected to extremely high temperature and severe thermal cycling. Since such a condition will produce both creep- and fatigue-damage in tubes, creep-

fatigue interaction should be taken into consideration not only in tube-material selection but also in structural design for fuel-cell reformer. In this study, a suitable life assessment method for reformer tubes was developed by analyzing creep-fatigue data on various materials. Also, appropriate tube materials were discussed applying this method to the model tube under a typical operating condition.

45219 (CONF-861008—Absts., pp 288-291) **Testability analysis of a fuel cell air pressurization system using the system testability and maintenance program (STAMP).** Unkle, C.R.; Himpler, H.P. Jr. (ARINC Research Corp., Annapolis, MD (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

This paper describes a computer-aided model, used for conducting testability analyses and development fault-isolation strategies, and its application to a major subsystem of a fuel cell power plant. The application was chosen to demonstrate the need for enhanced maintenance procedures and design for testability. The computer-aided model is ARINC Research Corporation's System Testability and Maintenance Program (STAMP). Through engineering analysis of the functional flow of a system, the first-order relationships among components and test points are determined. A dependency-analysis algorithm within STAMP then identifies all higher-order dependencies and their implications with respect to fault isolation and maintenance. This process permits a complete testability assessment, including automatic identification of component ambiguity groups, redundant test points, feedback loops, and multiple-failure conflicts. The model also provides testability measures that are useful in comparing competing designs and in evaluating the effects of testability design changes such as test-point relocations. STAMP also develops fault-isolation strategies. A new approach based on information theoretics provides trouble-shooting procedures that minimize the expected number of tests required. The STAMP fault-isolation approach can consider such important factors as failure rate, test time, and test cost to yield strategies that have optimal characteristics with respect to the use of maintenance resources. In summary, STAMP is a powerful, flexible tool for improving design testability and maintenance characteristics.

45220 (CONF-861008—Absts., pp 292-294) **Effect of improved heat transfer catalyst support on steam reforming of methane.** Rohatgi, N.; Voecks, G.E. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

For the past few years at JPL, an alternative catalyst system has been under investigation for steam reforming in which a metal is used as the catalyst support as opposed to a conventional alumina particle packed bed. The purpose of examining this novel catalyst system was to determine the extent to which the heat transfer improvements that a metal support would offer to the steam reforming activity could be achieved, while at the same time reducing the bed pressure drop. The initial work was done with an alumina-washcoated, nickel-catalyzed, honeycomb design monolith of thin metal support. The activity that was recorded was better than that of a comparable packed bed of conventional nickel steam reforming catalyst. The pressure drop was on the order of two orders of magnitude less in the honeycomb monolith due to the high void fraction. While this catalyst had not been optimized for performance, it did illustrate that the use of a metal support could provide important improvements in the operation of a steam reformer. The questions which were raised were (1) how much was the heat transfer improved by use of the metal support, (2) what was the important heat transfer mechanism that assisted in this activity if heat transfer was improved, and (3) was the activity of the nickel increased by use of the washcoating approach rather than heat transfer improvements being responsible for the improved performance. Studies were commenced in order to answer these questions. The methodology and results are described.

45221 (CONF-861008—Absts., pp 295-298) **Integrated electrode substrate of phosphoric acid fuel cell (KES-I).** Fukuda, H.; Shigeta, M. (Kureha Chemical Industry Co., Ltd., Tokyo (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Various kinds of carbon electrode substrates for phosphoric acid fuel cell (PAFC) have been developed at Kureha Chemical Industry Co., Ltd. In addition to a carbon paper type and a mold type, which are currently sold to fuel cell manufacturing companies, an Integrated Electrode Substrate (KES-I) has been developed for the purpose of lowering the electrical and thermal resistance, improving the strength and reducing the cost. This paper presents the features of the KES-I.

45222 (CONF-861008—Absts., pp 299-302) **Computer analysis of cooling effects in phosphoric acid fuel cell stack.** Lu, C.; Presler, A.F. (NASA Lewis Research Center, Cleveland, OH (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

For the design of phosphoric acid fuel cell (PAFC) systems, modeling is needed to obtain the local current generation as a function of temperature, pressure, reactant utilization, flow rate, feed concentrations, voltage, etc. A generic engineering analytic model for simulating the performance of PAFC power plant is developed by combining energy, mass, and electrochemical analyses. This model calculates the temperature, current density (CD), and flow rate distributions for various coolant and design configurations specified by the user. It also is used to determine the effects of design and operating parameters on the performance. Two examples of the simulations are presented here. A figure shows the temperature distribution as calculated by the model for an air-cooled PAFC plate of similar size and characteristics as that of Westinghouse stack 561. A branched cooling configuration is applied in the cooling plates which are separated by five cell plates. It is noted that the hot-spot is shifted to right as the fuel input temperature is much lower than mean operating temperature. Secondly the temperature distributions within a water-cooled PAFC stack are presented for a system having seven cell plates sandwiched between each pair of cooling plates, which is similar to IFC 10-ft^2 short stack. A 30-pass serpentine type cooling tube is molded in the cooling plate.

45223 (CONF-861008—Absts., pp 304) **Economic study on fuel cell power generation at Kenteng village in Indonesia for rural electrification.** Moechtar, M. (BPP Teknologi, Jakarta (Indonesia)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The increased emphasis on rural development in Indonesia will mean increased demand for small-scale sources of energy, since most rural areas in Indonesia will not be reached soon by the electric grid. For example, small-scale energy sources are needed to power public TV set, small pumping system for drinking water, refrigerator for health center, and other small electric appliances for households in remote areas. Fuel cells cost more initially than does the equipment now in widespread use for such applications - chiefly primary cells and diesel generator - similar to solar cells - but in many cases will be cheaper in the long run. This paper discusses the cost comparison of energy generated by fuel cell power generation, solar cell, diesel generator, and the extension of electric grid. The site that is chosen for this study is Kenteng, an agricultural village. The results indicated that there are sufficient economic incentives for fuel cell power generation in this case if the projected goals of capital cost and heat rate can be met.

45224 (CONF-861008—Absts., pp 305-307) **Modeling of porous gas-diffusion electrode structures for phosphoric acid fuel cells.** Stonehart, P.; Ho, A.N.; Cutlip, M.B.; Yang, S.C. (Stonehart Associates, Inc., Madison, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Progress in the development of optimized gas-diffusion electrode structures for phosphoric acid fuel cells requires a detailed understanding of the physical parameters operating within the porous electrodes. The challenge heretofore has always been to obtain a sufficiently detailed model that takes into account all of the kinetic, conduction (electronic and ionic), and diffusion parameters (gas-phase and liquid-phase), operating within the porous electrode structure. Previously the link between the theoretical models and real experimental data has not been sufficiently solid so that predic-

tive capabilities for development of real electrode structures could be obtained. The present work has fulfilled that connection and exact descriptions of dynamic processes within porous gas-diffusion electrode structures have been obtained. The linkage between the experimental data and the theoretical model is very good.

45225 (CONF-861008—Absts., pp 308-312) **Assessment of molten carbonate and phosphoric acid fuel cells for utility central station applications.** Krumpelt, M.; Minkov, V.; Daniels, E.; Dennis, C. (Argonne National Lab., IL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW. Contract W-31-109-ENG-38.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Considerable government resources have been allocated to the development of fuel cells in recent years. Motivated by projected oil conservation, major programs were initiated in the late seventies to scale-up the Phosphoric Acid and Molten Carbonate fuel cells. Due to their high efficiency and their ability to operate on gasified coal, the fuel cells were seen as an excellent technology for future utility base-load plants. Much has changed in the world economy since these programs were initiated. Energy prices have not risen as anticipated and capacity projections by utilities have been revised downward. A reassessment of the economic viability of fuel cells for the intended applications is needed. The difficulty of assessing fuel cells for power plant applications is in estimating the economics of such plants on a consistent basis with more mature technologies. Plant costs for a technology that is still in a development stage are often grossly underestimated simply because the need for certain types of equipment is not recognized. Then, when estimating the operating costs, developers tend to be optimistic in their performance assumptions. Recognizing these sources of error the authors emphasized the engineering aspects of the cost analysis in the assessment reported here.

45226 (CONF-861008—Absts., pp 313-316) **Comparison of phosphoric acid fuel cells to internal combustion engine cogeneration systems as suppliers of uninterruptable power.** Alling, G.C. Jr.; Miles, C. (Arthur D. Little, Inc., Cambridge, MA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The US Navy operates a number of facilities around the world which require highly reliable or uninterruptable power. The conventional method for satisfying this need is to install a number of back-up engine-driven generators and power conditioning equipment. The number of generators is dictated by the level of redundancy needed to meet the reliability goal. The conventional solution to this problem dictates that a large capital investment remains unused most of its life. The Navy Civil Engineering Laboratory commissioned Arthur D. Little, Inc. to study the economic feasibility of using the stand-by equipment in a cogeneration mode. In this study, ADL used a lifecycle cost-benefit analysis to compare a phosphoric acid fuel cell based system and two internal combustion engine based packaged cogeneration systems to the conventional uninterruptable power system (UPS) option. The key features of the three cogeneration systems are summarized in a table. Most of these data were supplied by the manufacturers of the respective systems. Most fuel cell data were provided by United Technologies Corporation. The fuel cell cost is an ADL estimate for moderate production levels. The basis of comparison was a simulated hospital building in Washington, D.C. Cogenerated thermal energy was used to meet service hot water and space conditioning loads while generated electricity satisfied both equipment and lighting loads. The results show that, of the three systems, the fuel cell has the lowest lifecycle cost and greatest net lifecycle savings. One of the IC engine based systems also shows positive lifecycle savings while the other does not.

45227 (CONF-861008—Absts., pp 317-320) **Site specific fuel cell/coal gasification plant designs.** Grant, T.J.; Estreich, P.J. (Ebasco Services Inc., New York, NY (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Ebasco Services Incorporated was commissioned by the Department of the Army (DOA) to study whether fuel cell technology could be combined with a coal gasification cogeneration program at specific sites where coal conversion potential existed. The objective of the program was to determine if the fuel cell/coal gasification concept would lead to increase in energy efficiency, higher conversion standards, and economic benefits sufficient to attract third-party equity investment to off-set a significant portion of the funds required from the DOA. This paper reports on the designs of the fuel cell/coal gasification plant for the four sites chosen. Each site-specific design took into account the indigenous coal supply alternatives, land use, present and future thermal-electric demand, local energy markets, climate, aesthetic requirements and other variables. System designs were developed around an 11.6 MW fuel cell module being developed by United Technologies Corporation (UTC) and 7.5 MW fuel cell module being developed by Westinghouse. The four plant sites were: Georgetown University Campus, Washington, D.C.; Scranton Army Ammunition Plant, Scranton, Pa.; Fort Hood, Texas; and Fort Greely, Alaska.

45228 (CONF-861008—Absts., pp 321-324) **Developments and applications of phosphoric acid fuel cell power plant models.** Lu, C.; Presler, A.F. (NASA Lewis Research Center, Cleveland, OH (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Under DOE support, NASA Lewis Research Center (LeRC)/Cleveland State University (CSU) have developed simulation models capable of predicting the Phosphoric Acid Fuel Cell (PAFC) power plant system performance under steady and transient states, and of designing the configuration of components and the synthesis of systems optimally. The nature of these models and their applications are presented. Two kinds of computer models are developed. One is the system model and the other is the engineering model. The system or single-stage model calculates the material and energy balances and the physical and chemical properties of the streams at one operating condition, such as the mean temperature and pressure. The engineering or multi-staged model, which usually is solved by the finite-difference method, handles the balances and properties at different sections. There are four areas of application that the developed models could operate in. For the system model these are: (1) to use on the system conceptual designs, where the layouts of power plant systems, with various fuel processors (i.e., coal gasifiers, methane steam reformer, and shift converters), are defined; (2) to perform, being combined with cost and optimization models, the trade-off and sensitivity analyses of system synthesis. For the engineering model these are: (1) to simulate the designed system's performance in the transient state (i.e., load changing period; (2) to optimize the component configurations and operating conditions.

45229 (CONF-861008—Absts., pp 325) **Fuel cell and fuel cell/battery hybrid power sources for vehicles.** Patil, P.G.; Huff, J.R.; Murray, H.S. (Dept. of Energy, Washington, DC (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Fuel cells potentially can provide the range advantages of an ICE in a power system but with clean and quiet operation. Because a fuel cell will deliver power as long as fuel and air are supplied, the range is limited only by the amount of fuel carried. Proton exchange membrane (PEM) fuel cells show the most promise for use in passenger vehicles. The features of a PEM system are discussed. Decomposed methanol is proposed as the fuel. However, the system may be limited in its ability to respond to severe load transients because of the thermal inertia of the fuel processing system. Furthermore, in order to be able to satisfy the large peak power requirements in automotive duty cycles, the fuel cell system may require cooling, fuel delivery, and reaction air supply subsystems sized to meet peak power conditions, thereby worsening weight and volume considerations. For these reasons and because of improvements in battery performance over the past several years, a fuel cell/battery hybrid power source feasibility study was carried out based on phosphoric acid and PEM fuel cells in conjunction with advanced lead-acid and nickel-zinc batteries. Fuel cells and batteries complement each other for the electric propulsion automotive application, providing long range, peak acceleration power, and recharge capabilities. As a hybrid configuration, the fuel cell/battery system may offer the advantage of reduced complexity, weight and volume compared to ICE/battery hybrids because the

fuel cell and battery both have electrical outputs, eliminating the need for complex mechanical-electrical couplings. Results of this hybrid assessment are discussed.

45230 (CONF-861008—Absts., pp 326-332) **Financial and strategic benefits of fuel cells.** Rigney, D.M.; Farber, M. (Electric Power Research Institute, Palo Alto, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The conventional means employed by utilities to evaluate which generation technology to use focuses on production cost comparisons and the present value of future revenue requirements necessary to cover the cost of production, return of capital investment and the approved rate of return to the utility. Utilities use sensitivity analyses to determine how much the study results will change due to some incremental change in input data. But utilities have found that this approach can lead to plant construction programs that are lowest cost in the long term (20 to 30 years) if the assumed conditions prevail, but that are, in the near term, terribly inflexible and financially disastrous in times of uncertainty if some conditions change radically such as load growth, cost of plant, or construction lead times. It's not a question of planning to meet what you think might happen; it's a matter of planning to be flexible enough to respond to a number of situations that you don't think will happen, but that are too important to ignore. The high efficiency fuel cell with its modular character, small size and short lead time was seen as a technology that would give utilities the financial flexibility they need in times of uncertainty where the wrong decision could ruin the company and/or cause excessive burdens on the ratepayer. EPRI and the Fuel Cell Users Group (FCUG) therefore formed a task force of utility planners (system, financial and corporate) to assist EPRI in identifying and quantifying the financial and strategic benefits of applying fuel cells. The approach used, the results, and general observations are discussed.

45231 (CONF-861008—Absts., pp 333-336) **Coalbed methane as a fuel for fuel cell power plants.** Ellis, A.F.; Newton, M.T.; Brett, C.E.; Thompson, D.A. (Southern Co. Services, Inc., Birmingham, AL (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

On January 31, 1986, Southern Company Services (SCS), along with Kaneb Services and The University of Alabama School of Mines and Energy Development (SOMED), completed a test project that included the first operation ever of a fuel cell with coalbed methane fuel. The test verified that onsite fuel cells are highly efficient and capable of using the large (approximately 800 trillion cubic feet) US resource of coalbed methane. The results were achieved during a 16-month test of a 40-kW phosphoric acid fuel cell at The University of Alabama Student Recreation Center in Tuscaloosa, Alabama. SCS, Kaneb, and SOMED funded the installation, operation, and maintenance of the fuel cell at the recreation center. Several unique features made the recreation center a particularly attractive test site, including its design and construction as an energy efficient building incorporating aquifer thermal energy storage and passive solar principles. However, of most importance was the presence nearby of two coalbed methane production wells which support ongoing University of Alabama research programs to recover natural gas from coal seams located some 2000 feet beneath the campus. These wells provided the opportunity for operation of the fuel cell on coalbed methane. Performance results are given.

45232 (CONF-861008—Absts., pp 337-340) **Operation of fuel cells on landfill gas fuel - utility, contractor, and manufacturer perspective.** Leeper, J.D.; Warren, D.W.; Pietrogrande, P.; Handley, L.M. (Southern California Edison Co., Rosemead (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

This paper describes how three individual companies worked together to prove the viability of using landfill gas in a phosphoric acid fuel cell power plant (FCPP). The companies are: Southern California Edison Company (Edison), an electric utility; Kinetics Technology International Corporation (KTI), a worldwide engineering contractor; and International Fuel Cells Corporation (IFC), a leading fuel cell manufacturer. The FCPP was installed at the Industry Hills Exhibit-Conference Center and operated on a landfill gas feedstock which was upgraded to natural gas specifications. The gas was upgraded by using activated carbon for trace contaminates removal and a membrane system for CO_2 removal. The Industry Hills FCPP operated over 5500 hours proving the technical viability of using processed landfill gas. Although the technical feasibility of FCPP operation on upgraded landfill gas was confirmed, internal studies indicated that the economic viability of fuel cells could be enhanced by using landfill gas without the costly equipment necessary to upgrade the fuel to natural gas specifications. In order to explore the feasibility of direct biogas utilization in FCPP's, KTI was contracted by Edison to analyze the performance and identify any potential problems of operating the 40 kW PC18 FCPP on untreated landfill gas, i.e., without CO_2 removal. KTI developed for Edison an analytical model which considered both process and instrument related capacity limitations. KTI concluded in that assessment that with appropriate control modifications, the PC18 was capable of achieving 50-75% of the rated capacity. In the following subsections, each of the program participants present their own unique perspective on the subject of biogas utilization in FCPP.

45233 (CONF-861008—Absts., pp 341) **MTCI's advanced fuel processor development.** Mansour, M.N.; Durai-Swamy, K. (Management and Technical Consultants, Inc., Columbia, MD (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Management and Technical Consultants, Inc. (MTCI) is developing an Advanced Fuel Processor that has successfully processed No. 2 fuel oil under a DOE Contract. MTCI's Fuel Processor employs a two-stage system in which the first stage is a fluidized bed catalytic reactor. MTCI built and operated the first stage on No. 2 fuel oil. In a DOD funded study, more than 99.9% of the feedstock (DF #2) was reformed to product gas in the first stage, with virtually no soot formation or other carbon laydown on the catalyst. The demonstrated system was a bench scale unit operating at 40 to 60 psig and 1650 to 1800°F with feed rates of oil in the 3 to 7 lbm/hr range and steam-to-carbon ratios of 3 to 10. A novel feature of the bench scale unit is a proprietary 12 KW immersible electrical heater which can operate up to 1900°F continuously. Description of results obtained in the above study are presented in the paper.

45234 (CONF-861008—Absts., pp 342-345) **Air Force remote site fuel cell development program.** Taschek, W.G.; Turner, J.M.; Fellner, J. (Army Belvoir RD & E Center, Fort Belvoir, VA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The objective of this congressionally mandated program is to demonstrate logistic fueled fuel cell power plants at an Air Force remote site in Alaska in the early 1990s. Performance goals are 40% electrical efficiency based on the fuel's lower heating value, 20 year life and 30% life cycle cost savings over existing diesel engine generators. Primary aspects of the program are: field test a 40 kW power plant at Elmendorf Air Force Base, Alaska; demonstrate processes capable of converting diesel fuel to fuel cell quality hydrogen; establish requirements for remote site fuel cell power plants and determine performance and life cycle cost baseline of the competition; conduct the Remote Site Fuel Cell Development; and demonstrate power plant(s) at an Air Force site in Alaska in the early 1990s. The paper describes the 40 kW power plant field test at an air base, fuel conditioning, and site evaluation and life cycle cost.

45235 (CONF-861008—Absts., pp 346-349) **Market assessment of by-product gaseous fuels for phosphoric acid fuel cells.** Torrey, J.M.; Leeper, J.D. (Science Applications International Corp., La Jolla, CA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Southern California Edison (Edison) is a leader in evaluating fuel cells that operate on by-product gaseous fuels. The completion of a 40 kW fuel cell field test at the Industry Hills Exhibit-Confer-

ence Center has proven through operation on landfill gas that the fuel cell technology can utilize waste derived fuels. The use of by-product gaseous fuels for power generation offers a utility and its customers many benefits including the displacement of scarce fuel oil and natural gas resources, and a decrease in the adverse social impact of by-product waste disposal. This paper presents the results of a study by Science Applications International Corporation (SAIC), looking at the technical and economic market potential for 11 MW fuel cell power plants within Edison's territory.

45236 (CONF-861008—Absts., pp 350-353) **Prospects of fuel cell application for industrial use in Japan.** Shioiri, M.; Satomi, T. (Institute of Applied Energy, Tokyo (Japan)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Fuel cells offer advantages over the conventional process of power generation in that they: raise the efficiency of generation; plants in the small 100 kW-1 MW class could develop the efficiency equivalent of large scale power generation; and product waste heat of a relatively high temperature which could be combined with electricity for use in achieving a higher level of overall efficiency. They are expected to serve actually for on-site use, as well as purposes of utility generation. The likelihood is that fuel cell applications for industrial use give reasonable promise of introduction: (1) at the time when the existing autogeneration installations are replaced, and (2) in the type of industry which has relatively small scale factories failing to show their economic merits with conventional systems. Entry into these markets will not be gained unless steps are taken to resolve such technical problems as: (1) achieving the desired installation cost and performance goals, (2) assuring reliability and operability (maintenance-free and other features) on a level not inferior to the existing generating installations, (3) developing technology for the recovery of high temperature waste heat of high utility value, and (4) promoting diversification of working fuel.

45237 (CONF-861008—Absts., pp 354-357) **Applications of fuel cells to the petroleum refining industry.** Altseimer, J.H.; Roach, J.F.; Krupka, M.C.; Anderson, J.M. (Los Alamos National Lab., NM (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Los Alamos National Laboratory has been analyzing and assessing potential applications of fuel cells in the period 1990 to 2000. A report on chlor-alkali industry applications has been published and a report on petroleum refinery applications will be published in the near future. This paper deals with the refinery study. The different process requirements of the industry were characterized and energy requirements determined. The competitive cogeneration systems were also characterized. To assist in the technical characterizations, a questionnaire was sent to planning personnel in all of the major refinery plants in the US. Using a Los Alamos computer code, levelized energy (steam + electricity) costs were calculated for the different competitive systems to determine their economic competitiveness. Other economic factors were also evaluated that might have a bearing on the choice of a cogeneration system. In addition to three fuel cell technologies considered for petroleum refinery applications, the gas turbine combined cycle (GTCC), and coke fluidized bed boiler (CFBB) options were included in the overall analysis. The three fuel cell technologies were phosphoric acid (PAFC), molten carbonate (MCFC), and solid oxide (SOFC). The GTCC technology is the most likely competitive cogeneration system in the coming decade. Results are discussed.

45238 (CONF-861008—Absts., pp 358-359) **Fuel cell integration with renewable power technologies: some technical possibilities and potential impacts.** Sissine, F. (Library of Congress, Washington, DC (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Changing wind speeds and solar insolation levels can cause the power output of wind and solar-electric technologies to vary dramatically from minute-to-minute and from day-to-day. This problem of output variability is a major constraint on the number of applications and the energy contribution which can be derived from wind and solar-electric technologies. Fuel cells have recently demonstrated a capability to accommodate rapidly changing power demands, and may offer new hope for solving the output variability problem. This suggests that their combination with renewable power technologies could yield a system which produces firm power and derives much of its energy from renewable resources. Such complementarity could enhance the attractiveness of wind farms and other solar operations to electric utilities. It could also spawn a new generation of firm power technologies for rural and isolated areas. However, there are three technical problems which must be addressed in order to prove that fuel cells can be successfully integrated with wind and solar electric technologies. First, although the Gas Research Institute field tests have shown that small fuel cells can follow commercial building loads, the adequacy of these designs to match the more erratic output patterns of wind machines and wind farms is yet to be demonstrated. Second, the technological requirements for integrating fuel cells with wind and other renewable energy technologies remain to be explored. Third, it has not yet been shown whether fuel cells can compete economically with diesel engines as an output-leveling device for renewable power technologies. These three constraints are briefly discussed.

45239 (CONF-861008—Absts., pp 361-363) **Potential of fuel cell applications for decentralized power generation in India.** Pandya, J.D. (Tata Energy Research Institute, New Delhi (India)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The prevailing energy scenario demands new strategies for energy and power generation technology to provide a modicum of substantial energy supplies to the millions in the countryside. Fuel cell power plants operating on locally available fuels, therefore, can become the most crucial factor in power planning in the country. The potential availability of fuels for phosphoric acid fuel cells was examined in detail. Three fuels, namely, natural gas, ethanol and biogas have been found suitable with specific reference to Indian conditions. Biogas is mainly produced from anaerobic digestion of animal wastes in India. Whereas ethanol is produced by fermentation of molasses. The cost of electricity generation using fuel cells was compared with other options for decentralized electricity generation such as photovoltaic and wind turbines. Though the fuel cell option is found to be attractive as compared to other decentralized options, the cost of fuel cell stack has to be reduced to about $1000/kW to provide electricity at a more competitive price than central grid supply. However, given the rapid growth in demand for power in the country and the increasing capital intensity and peak to base load power ratio, it is unlikely that the growing gap between demand and supply would be reduced. The present situation offers ample opportunities for the application of small sized (10-200 kW) fuel cells. A field demonstration project should be undertaken to carry out a site specific techno-economic feasibility of fuel cell biogas/ethanol system in India.

45240 (CONF-861008—Absts., pp 364-368) **National fuel cell program and its application in Indonesia - a proposed program.** Moechtar, M.; Soelaiman, T.M. (BPP Teknologi, Jakarta (Indonesia)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

This paper describes the long-term proposed program of a National Fuel Cell technical capability and application in Indonesia. The proposal for this program will be prepared by an Indonesia Fuel Cell Group which consists of researchers, scientists, entrepreneurs, government official, potential users, and interested foreign counter-parts. The first goal of this program is to acquire, analyze, and document of fuel resources data in Indonesia. In this task, there will also be a study on the fuel cell market penetration in Indonesia. The other sub-programs will be emphasized on the development of technical capability.

45241 (CONF-861008—Absts., pp 369-371) **PC23 fuel cell: a strategic alternative.** Handley, L.M.; May, G.W. (International Fuel Cells Corp., South Windsor, CT (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

International Fuel Cells is designing and developing a new fuel cell power plant, designated the PC23, for sale to utilities. The PC23 is a complete, self-contained generating plant which converts natural gas or liquid hydrocarbon fuel into three-phase power at the utility's distribution voltage. It produces 11 megawatts net ac at a heat rate of 8300 Btu/kilowatt-hour. The PC23 has the fast response and good part-power efficiency needed by an intermediate generator. As other fuels - coal gases, landfill gas, digester gases - become available, these plants can be adapted to use them. Heat from the plant can be recovered; in this way up to 80% of the fuel energy can be utilized. To provide a complete power plant design consistent with US utility standards at a minimum cost, IFC entered last year into a cooperative agreement with Bechtel, one of the world's most experienced power plant engineers-constructors. Bechtel complements IFC's fuel cell capabilities by preparing the PC23 standard plant arrangement, designing and furnishing the support systems, and providing on-site installation services. The PC23 support systems to be furnished by Bechtel include plant fire protection, auxiliary electric power supply and distribution, and plant service systems. Bechtel will use the same design approach as IFC by developing factory-assembled, truck-transportable modules for these systems. In addition, Bechtel is also reviewing the overall design and arrangement to ensure consistency with utility operations and maintenance practices as well as safety and quality.

45242 (CONF-861008—Absts., pp 372-374) **Westinghouse 1.5 MW fuel cell pilot power plant: the next step to commercialization.** Newby, D. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

The Westinghouse commercialization program for air-cooled phosphoric acid fuel cells is directed toward a standardized, factory produced 7.5 MW Power Plant. These plants should be available for commercial sales in the early 1990's, however, acceptance by the Utility Industry will require firm operating and economic data. Westinghouse believes that this data should be developed jointly with interested Utilities to ensure suitability for their decision making process. Additionally, to ensure acceptance of their commercial offering, the plant should be developed with as broad a spectrum of Utility technical input as possible. To achieve these objectives, Westinghouse intends to build a 1.5 MW Pilot Power Plant as the next step in their commercialization program and is soliciting Utility financial and technical participation. The design of the proposed pilot plant is described and an approach which minimizes the financial commitment of any one participant is discussed.

45243 (CONF-861008—Absts., pp 375) **Commercialization of Engelhard phosphoric acid fuel cell technology.** Hooie, D.T. (Engelhard Corp., Edison, NJ (USA)). Oct 1986. NTIS, PC A 17. Order Number DE88008298/JAW.

From Fuel cell seminar; Tucson, AZ, USA (26 Oct 1986).

Engelhard is currently developing two fuel cell systems concepts: vehicular and on-site. A discussion of the prototype testing and commercialization plans for each of these technologies are discussed. Vehicular systems range from 5 to 30 kW and can be fueled by methanol or No. 2 diesel. Propane is also being examined as a potential fuel. This technology is expected to be commercially available by 1988. Engelhard is also developing an on-site system in the module size range of 25 to 50 kW. These modules can be used individually or combined to multi-megawatt size and can be fueled by any hydrogen-rich stream. Prototype testing of these units is planned beginning in 1987.

45244 (NEDOJ—8703, pp 306-321) **Research and development of phosphoric acid fuel cell power plant. For dispersed storage and generation-low-temperature low-pressure type.** Kaneko, Hideo. (Fuji Electric Co., Ltd., Tokyo, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

Research and development of phosphoric acid fuel cell power plants has been carried out since 1981 as part of the Moonlight program. This report deals with results of studies made in 1986. Subsystems involving water/vapor, air and refining were set up first, followed by checking of reformer performance, adjustment of the plant using a dummy stack, and overall performance testing and verification using a cell. It was revealed that the water treatment apparatus fully met the design requirements for water properties and that the hot water generation apparatus for activation and the cooling tower was able to show satisfactory performance. Good results were also obtained in performance testing of the turbo compressor for air subsystems and the emergency nitrogen gas facilities. Testing for flow rate and composition of gas in the reformer process demonstrated that they had no adverse effects on the operation of the main cell unit. After adjusting the plant using a dammy stack, a 1 MW fuel cell is installed and trial power generation was started in June 1987. A 100% load test was carried out in August. Results demonstrated that the environmental values of NOx, SOx and noise were low, as expected from the use of a fuel cell, and successfully achieved the target.(15 figs, 5 tabs)

45245 **(NEI-NO—43) Fuel cells. An evaluation of the status and possible adaption of the technology in Norway.** Gaudernack, B.; Solberg, K.O.; Skartsaeterhagen, S.; Thoresen, P.; Stoerkersen, N.; Johansen, K.H. (Institute for Energy Technology, Kjeller (Norway)). Jul 1987. 112p. (In Norwegian). NTIS (US Sales Only), PC A06. Order Number DE88753701/JAW.

This is a report to the Energy committe of the Norwegian Council for Scientific and Industrial Research. A description is given of the general principles of the fuel cells, which can convert the energy content of fossil fuels (e.g. natural gas) to electric power. The technological status of the most important types of fuel cells is presented, and the possibilities for commercialization are discussed. As a major producer of natural gas, Norway is interested in a technology which can increase the utilization and application of this resource. From the point of view the consumers, there is an interest in the fuel cell technology as an efficient and flexible electric energy generation alternative, which does not cause considerable environmental concerns. The possibilities to introduce fuel cells in the Norwegian power supply system is also discussed. Up to now, there has been no great development effort in fuel cell technology in Norway. For the further effort it is of importance that the various Norwegian interests are coordinated. It is recommended to perform a study and planning phase of 6-9 months duration. The goal should be en integrated plan, e.g. 15 years plan, for Norwegian research and development within the full cell technology. 7 refs., 15 figs.

45246 **(PB—88-201868/XAB) Fuji Electric Journal, Vol. 61, No. 2, 1988.** (Fuji Electric Co. Ltd., Tokyo (Japan)). 1988. 77p. NTIS, PC E04/MF A01.

Text in Japanses with English abstracts. See also PB—88-201876 and PB—88-151451; Portions of this document are not fully legible. Color illustrations reproduced in black and white.

The table of contents includes the following: 1000-kW phosphoric acid fuel cell power plant - Outline of the plant; 1000-kW phosphoric acid fuel-cell power plant - Fuel processing system; Demonstration test of a 50-kW PAFC power plant; Phosphoric acid fuel-cell technology; Present status and forecast of fuel-cell technology; 1000 kW phosphoric acid fuel-cell power plant - Fuel-cell stacks; 1000 kW phosphoric acid fuel-cell power plant - Inverter; Development of small-capacity fuel-cell power units; Development of alkaline electrolyte fuel-cells; Commercialization of fuel-cell power plants; Development of molten carbonate fuel-cells; Development of steam reformers for fuel-cell power plants.

45247 **(PB—88-201876/XAB) Present status and forecast of fuel-cell technology.** Anahara, R.; Mieno, I. (Fuji Electric Co. Ltd., Tokyo (Japan)). 1988. 7p. NTIS, PC E04/MF A01.

Text in Japanses; Included in Fuji Electric Jnl., Vol. 61, No. 2, 119-124(1988).

This article describes the recent development and commercialization of fuel-cell technology in the world and in Fuji Electric as well. Fuji Electric now holds a leading position in the field of phosphoric acid fuel-cell plants in Japan and also shows excellent results in the development of high-performance molten carbonate fuel cells. Examples of developments in phosphoric acid-fuel cell plants are illustrated namely: large-scale electric-utility applications and small-scale on-site uses.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 44545, 45566

45248 **(BFR-R—16-1987) Loudden heat pump. Performance assessment of a district heating heat pump using sewage effluent as its heat source.** Enstroem, H.; Solin, L. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 125p. (In Swedish). NTIS (US Sales Only), PC A06. Order Number DE88753673/JAW.

The objective of this project has been to check the performance of the plant and to make suggestions for improvements. Data acquisition has worked well, and so adequate data are available for assessment. The report describes performance aspects, such as thermal power output and coefficient of performance, as well as availability. As a number of points in the refrigerant circuit were included among those monitored, diagrams of the actual heat pump process are also included. The report makes a number of suggestions for service routines and improvements to the plant. (authors).

3201 Buildings

REFER ALSO TO CITATION(S) 44916, 44916, 45248, 45323, 45694, 45722

45249 **(ASHRAE/SP—49) Thermal performance of the exterior envelopes of buildings III: Proceedings.** (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA; USDOE, Washington, DC; Building Thermal Envelope Coordinating Council, Washington, DC (USA)). 1986. 1421p. (CONF-851202—). NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE88012471/JAW.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

This report is a collection of the proceedings of the ASHRAE/DOE/BTECC conference of December 2-5, 1985. The following general topics are covered: In-Situ Measurement of Energy Use; Microclimate and Design Weather Data; Air Infiltration; Thermal Analysis of the Building Envelope; Retrofitting Techniques and Performance; Design of Buildings in Extreme Hot and Cold Climates; Impacts of Moisture; Test Procedure Development and Building Diagnostics; Fenestration and Daylighting; Innovative Construction Practices; Design of Energy-Efficient Envelopes; Guidelines, Standards, and Codes; Thermal Mass and Transient Effects in Buildings and Building Envelopes; Integration of Architecture and Engineering in Energy Conservation Including Economic Optimization. Separate abstracts have been prepared for the individual papers in this proceeding. (JF)

45250 **(BFR-R—5-1987) Performance measurement and evaluation of a heat pump system with wind convectors. An installation on a nursing home/medical centre in Mariefred.** Lagerkvist, K.O.; Larsson, R. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 86p. (In Swedish). NTIS (US Sales Only), PC A05. Order Number DE88753670/JAW.

The objective of this work has been primarily to ascertain the amount of thermal energy supplied, and electrical energy consumed, by the heat pump installation. Other factors that have been investigated are concerned with the characteristics of the wind convectors as heat absorbers and icing and defrosting behaviour. A total of about 1105 MWh of heat was supplied during the measured year (from June 1984 to May 1985), of which about 711 MWh came from the heat pumps, with the remaining 394 MWh from the electric immersion heaters. The immersion heaters consumed about 406 MWh, the heat pumps 296MWh and other ancillary equpiment (pumps etc) about 28 MWh. The coefficient of performance of the entire heating system was 1.5. The electric immersion heaters supplied a total of about 52 MWh of electrical energy for defrosting, of which about 43 MWh was actually used for defrosting. The capital cost of the entire heating system amounted to about SEK 2.3 million, of which SEK 1.1 million was accounted for by the heat pump plant. The annual cost saving for the heat pump system alone amounts to a total of SEK 120.000. The total annual saving for the entire heating system amounted to about SEK 25.000. (authors).

45251 **(BFR-R—12-1987) Heat pump system abstracting heat from sewage effluent in Vaxholm.** Lagerkvist, K.O.; Larsson, R. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 30p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753672/JAW.

The basic heating requirement for the Kullaskogen residential area in Vaxholm is met by heat pumps abstracting heat from purified sewage effluent from the Blynaes sewage treatment plant. The effluent is pumped from the treatment plant to the heating plant through a 1.5 km long pipe, most of which is laid on the bed of a lake. The residential area consists of about 150 dwelling units, with a total residential area of about 13,000 m/sup 2/, and made up of detached houses, semi-detached houses and apartment buildings. Total power demand has been calculated as amounting to about 700 kW and annual energy demand to 1.9 GWh. The heating system has been designed to operate at a low temperature of 60/40 degrees C. Three electrically driven heat pumps have been installed. The heat pumps meet the base load heat requirement, with any additional heat being supplied by electric boilers. The heat pumps have supplied 70% of the annual heating energy requirement. The annual coefficient of performance of the heat pumps is 2.3 referred to the overall power consumption. During the year, a total of 1.9 GWh was supplied to the heat distribution system, and 1.2 GWh of electricity were purchased. This gives a total annual coefficient of performance of the entire heating plant of 1.6. (authors).

45252 **(BFR-R—32-1987) Umeaa energy conservation blocks.** Hoegberg, E.; Nordin, C. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 30 Sep 1986. 145p. (In Swedish). NTIS (US Sales Only), PC A07. Order Number DE88753678/JAW.

The objective of this project has been to: -develop methods of implementing energy conservation programs in practise: -develop aids for more reliable building diagnoses: -assess the efficacy of various energy conservation measures in practice, and - to follow up the effects of conservation on building economics (rents). A number of 'packets' of conservation measures have been evaluated from technical, operating economic and energy conservation viewpoints during Stage 2 of the work: -Basic packet of improvements, with fitting of thermostatic valves and adjustment of heating systems. -Measures intended to conserve water. -Individual metering of domestic electricity. -Heat recovery from exhaust air using heat exchangers and heat pumps. -Upgrading of double-glazed windows to triple-glazed. The planned energy conservation targets have been achieved. Consumption in the building to which the most measures were applied has dropped from 15 700 kWh per apartment to 9 600 kWh, i.e. a reduction of about 40%, with the remaining consumption amounting to about 130 kWh/m/sup 2/ for space heating and domestic hot water production. (authors).

45253 **(BFR-R—36-1987) Guldheden project - an energy conservation block in Gothenburg. Rebuilding an area from the 1950s for energy conservation.** Nilsson, A.; Fischer, M.; Nordberg, M.; Walter, A. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 189p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88753679/JAW.

The Guldheden project consists of nine similar 8-10 storey tower blocks dating from the beginning of the 1950s. A total of 332 apartments was affected by the implemented measures. The strategy for the project has been to apply integrated combinations of measures incorporating a considerable element of work intended to rectify defects in order to achieve a good overall economic result in spite of quite comprehensive building structural measures. Simple measures concerned with building services systems have been grouped into a combination of basic measures that have been applied to all buildings. These basic measures have then been made up with more comprehensive measures in seven of the buildings - various combination of insulation of exterior facades, roof insulation, upgrading of double-glazing to triple-glazing, application of exhaust air heat pumps to supply heat for domestic hot water production

and radiators and so on. Comprehensive measurements of energy and water consumptions, temperatures and other variables have been made in the buildings since 1982. The measurements, which were started before the improvements were applied, have mostly been made using newly-developed data-logging equipment. The specific purchased energy demand was reduced from 260 kWh/m/sup 2/ to 225 kWh/m/sup 2/ per year, while the most comprehensive combination was reduced to 145 kWh/m/sup 2//year. (authors).

45254 **(BFR-R—52-1987) Defrosting of air evaporators in heat pumps. Evaluation of defrosting methods.** Bergstroem, U.; Larsson, R. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 81p. (In Swedish). NTIS (US Sales Only), PC A05. Order Number DE88753680/JAW.

The objective of this work has been to make performance measurements of commercial outdoor heat pumps to determine the problems that arise in connection with defrosting of the heat pump evaporators. The measurements have shown that the various methods used to defrost evaporators operate satisfactorily. However, almost all the plants examined have exhibited problems with the control systems used to determine when defrosting is necessary. It is estimated that the financial savings from large heat pumps (1500 kW) could be increased by about SEK 60 000 per year simply by improving defrosting control. The report makes a suggestion for a control system intended to optimise the savings in connection with defrosting. (authors).

45255 **(BFR-R—53-1987) Lugnet sports complex in Falun. Evaluation of the use of a bandy rink as a solar collector in an integrated heating system.** Persson, S.E. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 204p. (In Swedish). NTIS (US Sales Only), PC A10. Order Number DE88753681/JAW.

The suggestion to use the bandy rink at the Lugnet sports complex as a solar collector during the summer to provide heat primarily for the proposed outdoor swimming pool was first put forward at the end of the 1970s. Trials in May 1980 indicated that it was easily possible to meet the necessary 1 MW power requirement with heat from the bandy rink when utilised as a solar collector. The indoor ice rink building, which contains not only its own refrigerating machinery but also that for the bandy rink, was originally built with a space heating system and domestic hot water system based on the use of direct electric heating. However, in connection with installation of a heat pump, a water-borne heating system was installed in the building, using waste heat from the refrigerating machinery. Hot gas heat exchangers for domestic hot water production and drying were also installed, as was a heat recovery system for cooling water and a central computerized control and monitoring system. The report describes the various parts of the system with flow diagrams, technical data, building costs and performance results. The most comprehensive chapter describes the bandy rink and its performance as a solar collector. Total savings in the cost of energy and water in 1985 amounted to SEK 340 000 of which the heat pump accounted for the greater part (64%).

45256 **(BFR-R—59-1987) Energy measuring in apartment buildings. Building services.** Fredlund, B. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 120p. (In Swedish). NTIS (US Sales Only), PC A06. Order Number DE88753682/JAW.

This report presents the results of performance measurements and the conclusions drawn from them in connection with energy conservation measures of both structural and building services types that were applied to energy conservation blocks in Malmoe between 1981 and 1985. The buildings concerned were erected between 1950 and 1968. The objective of the project was to document the potential for energy conservation and to identify the obstacles and problems involved in application and implementation of the necessary measures. The expected theoretical energy savings of 30-35% for the Hussvalan and Erikstorp blocks turned out to be far too optimistic. They were based on the assumption of substantial reduction in indoor temperatures, which were to be made possible through the fitting of a third pane of glass in windows and simple draughtproofing measures. In fact, the greatest savings achieved were no more than 12% in the Hussvalan block and 6% in the Erikstorp block.

45257 **(CEA-DAS—452) Criterions for fixing regulatory seismic acceleration coefficients.** Costes, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 10p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754198/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

Acceleration coeffficients to be taken into account in seismic areas for calculation of structures are defined in national seismic regulations. Joined to the described qualitative requirements, these coefficients represent a balance between precaution costs and avoided damages, both in terms of material repairing costs and damage to human life. Persons in charge of fixing these coefficients must be informed of corresponding quantitative aspects. Data on seismic motions occurrencies and consequences are gathered here and convoluted to mean damage evaluations. Indications on precaution costs are joined, which shows that currently recommended levels of seismic motions are high relatively to financial profitability, and represent in fact an aethical choice about human life value.

45258 **(CONF-8804100—1) Experimental evaluation of two refrigerant mixtures in a breadboard air conditioner.** Mulroy, W.; Kauffeld, M.; McLinden, M.; Didion, D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012933/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

An experimental, water-to-water, breadboard heat pump (that is one designed to be easily reconfigured) was constructed for comparison of pure R22 to the refrigerant mixtures R22/R114 and R13/R12. Three evaporator configurations were extensively studied. In all cases the best mixture outperformed R22. The best efficiency with R22/R114 was 32% higher and with R13/R12 was 16% higher than the best efficiency measured with R22. Other observations were, first, that mixtures can take advantage of heat exchangers efficiency that, in a gliding temperature application, a pure refrigerant is incapable of utilizing. Secondly, that heat exchange between the condensed and evaporating refrigerant is beneficial to some mixed refrigerants. Finally, mixtures exhibit nonlinearity of enthalpy versus temperature in the two phase region which has significant impact on both heat exchanger and cycle design. 12 figs.

45259 **(CONF-8804100—2) Assessment of Japanese variable speed heat pump technology.** Ushimaru, Kenji. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02. Order Number DE88013246/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

An analysis of critical component technologies and design methodologies for Japanese variable speed heat pumps are presented. The market for variable speed heat pumps in Japan is predominantly residential split-type, between the fractional to 2.5 ton capacity range. Approximately 1.1 million residential inverter-driven heat pumps were sold in 1987. Based on the market trends, component technology and several advanced features are described. Similarities and differences between Japanese and US system design methodologies are discussed. Finally, the outlook for future technology trends is briefly described. 8 refs., 6 figs., 1 tab.

45260 **(CRIE-W—86032) Development of advanced heat pumps (Part 1). Basic design and preliminary performance analysis.** Iwatsubo, Tetsushiro; Saikawa, Michiyuki; Hamamatsu, Teruhide. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). May 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753869/JAW.

A high performance hot and cool heat supply heat pump system was proposed to meet the problems of new demand development in the electric business and the load normalization by day and night, and its basic performance was evaluated. Merits of

motor-driven heat pump which meets the air-conditioning load for the office buildings, collective houses, and independent residential houses are energy-saving and convenience and cleanliness by the use of electricity. In this report, comparson was made with the conventional water and ice heat storage system. 1. This system gets both the high coefficient of performance and high storage capacity in cool storage mode by adopting the refrigerant gas clathrates. 2. Total system can be minimized because it can supply three different temperature loads with one heat pump system. (10 figs, 5 tabs)

45261 (DOE/CE—0224) Energy conservation goals for buildings: A report to the Congress of the United States. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). May 1988. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013159/JAW.

The Office of Buildings and Community Systems (BCS) conducts buildings energy conservation research and regulatory programs for the US Department of Energy (DOE). The Congress in House Report 100-171, concerning the Department of the Interior and Related Agencies Appropriation Bill, 1988, stated its expectation that a report be prepared which would: "delineate clearly the goals of the buildings portion of the program with regard to each type of building and building system, and how the program should be modified to meet these goals based on private sector and user needs." This report is in response to that Congressional expectation. It consists of three chapters: Chapter One provides an overview of the BCS role in improving the energy efficiency of buildings and presents overall goals for the program; Chapter Two discusses the BCS research program and its goals in more detail; and Chapter Three outlines how the BCS research program is modified to address private sector and user needs. 11 figs., 6 tabs.

45262 (ECRC/M—2237) Usage of hot water in dwellings having electrically heated storage cylinders. Stephen, F.R. (Electricity Council Research Centre, Capenhurst (UK)). May 1988. 31p. Electricity Council Research Centre, Capenhurst, Chester CH1 6ES, UK.

A survey of 43 households with electric water heating was undertaken to determine hot water usage. The results show that the hot water system is accessed frequently during the day with many small volumes of water being drawn from the hot taps. This usage pattern resulted in significant energy loss from the hot water residing in the distribution pipework. At the kitchen sink, where 40% of hot water was used, 37% of the volumes drawn were of cold and tepid water. Standing losses from hot water cylinders were also found to be significant and averaged 30% of electricity input for poorly insulated cylinders. Storage capacities in many existing installations were found to be inadequate to meet daily hot water demands, and householders were unable to take full advantage of off-peak tariffs due to the small cylinder volume.

45263 (LBL—22315-2/2) Indoor air quality and ventilation measurements in 38 Pacific Northwest commercial buildings: Volume 2, Appendices: Final report. Turk, B.H.; Brown, J.T.; Geisling-Sobotka, K.; Froehlich, D.A.; Grimsrud, D.T.; Harrison, J.; Koonce, J.F.; Prill, R.J.; Revzan, K.L. (Lawrence Berkeley Lab., CA (USA)). Dec 1987. Contract AC03-76SF00098;AI79-83BP12921. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014063/JAW.

This report, Volume 2, contains the Appendices of Volume 1. These Appendices contain experimental data obtained from air quality control measurements.

45264 (NLVF/S—690) Wood-burning stoves - further development. Karlsvik, E. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Feb 1987. 15p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753715/JAW.

The report discusses the development of wood-fuelled furnaces. The project concerns two main themes: Mapping of effluents such as CO-2, O2, CO, C-xH-y, tar, and dust in relation to future regulations/standards; comparing the various catalyst configurations in order to cost-favourable catalysts for woodfuelled furnaces. The project confirms a great demand of accuracy of measurement, and computer programs for the processing of compiled data and combustion processes modelling. New approaches are briefly compared. 5 drawings.

45265 (NP—8770227) Temporary thermal insulation of windows. Final report. Frank, R.; Schmid, J. (Institut fuer Fenstertechnik e.V., Rosenheim (Germany, F.R.)). Oct 1984. 116p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770227/JAW.

The author outlines the fundamentals of thermal insulation of windows and discusses commercial thermal insulation systems. Selection criteria are given (roller blinds, folding shutters, window shades, canvas blinds, venetion blinds, curtains, special constructions). Automation possibilities are discussed, and psychological factors influencing the choice of temporary insulation measures are mentioned (higher room comfort as a result of higher surface temperature, more efficient sound abatement, protection against burglars). (HWJ)

45266 (NP—8770321) Buildings of wood and mixed building materials. Latest developments, taking aspects of cost reduction into consideration. Lewitzki, W.N. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Architektur). 25 Nov 1986. 397p. (In German). NTIS (US Sales Only), PC A17. Order Number DE88770321/JAW.

Emanating from the past discussions about the attempts to build, saving both costs and ground area, which is practised nowadays, this dissertation deals firstly with the transferability of these attempts to building with wood. The basic requirements for wooden building with optimal costs and the dependence on the state normative regulations are assessed. Furthermore, the influence of individual systems on the cost structure is elucidated. The overlapping questions connected with this, questions of possible self-help, of rationalisation a flexibility of building systems are analysed and their reciprocal dependence is described. Finally, aspects of energy are examined. (HWJ).

45267 (ORNL/CON—256) Radiant barrier research plan. Wilkes, K.E.; Yarbrough, D.W. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 74p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013345/JAW.

Insulation systems based on highly reflective aluminum surfaces have been in existence for a number of years. Renewed interest in the application of these systems to buildings has been generated by recent experiments, especially those on the class of systems that are known as radiant barriers. Typical radiant barriers consist of a substrate material such as kraft paper or a polymer film with a thin reflective coating (usually aluminum) on one or both sides. Typical applications are in residential attics with the radiant barrier laid on top of the insulation or placed beneath the roof. Experiments by a number of groups have clearly demonstrated that radiant barriers are effective in reducing heat flows through ceilings of buildings, especially under conditions where the building is cooled. While the result of the experiments are in qualitative agreement in indicating heat flow reductions, the quantitative thermal performance of a long-term degradation of performance and potential moisture problems are two other issues relating to these systems. 20 refs., 4 figs.

45268 (PB—88-205844/XAB) Integrated gas-fired space-heating/water-heating system with electric air conditioning. Final report. January 1983-December 1987. Demetri, E.P.; Gerstmann, J. (Advanced Mechanical Technology, Inc., Newton, MA (USA)). Jan 1988. 121p. NTIS, PC A06/MF A01.

See also report dated Jan 85, PB—85-220063.

A Triple-Integrated-Appliance (TIA) for space conditioning and water heating was successfully developed for the multifamily housing market as an economical gas alternative to all-electric systems. The gas-fired portion of the system provides high-efficiency condensing operation in both the space-heating and water-heating modes. The TIA was evaluated in a comprehensive field-test program conducted nationwide at sites representative of multifamily applications. The field-test results demonstrated that the perform-

ance goals were achieved under actual usage conditions. The final pre-production prototype configuration provides the design and performance characteristics necessary to compete in the multifamily market.

45269 **(PB—88-213889/XAB) Outline of desiccant cooling program.** Kosar, D.; Novosel, D. (Gas Research Inst., Chicago, IL (USA)). May 1988. 17p. (GRI—88/0136). NTIS, PC A03/MF A01.

See also PB—83-126250.

This brief outline presents GRIs efforts related to gas cooling technologies and dessicant system development. GRI's Dessicant Development Program Budget is $5.350 million for 1987 and $5.450 million for 1988. Schematic diagrams are provided for various dessicant systems under development.

45270 **(PB—88-215470/XAB) Comparison of direct-digital-control and pneumatic-control systems in a large office building.** Bushby, S.T.; Kelly, G.E. (National Bureau of Standards, Washington, DC (USA). Building Environment Div.). Mar 1988. 56p. (NBSIR—88/3739). NTIS, PC A04/MF A01.

See also PB—84-178284.

A distributed, microprocessor-based direct-digital-control (DDC) energy management and control system was developed and installed in an eleven story office building in Gaithersburg, Maryland. Over a period of one year, the performance of this system under various control strategies was investigated along with the performance of a conventional pneumatic control system. The quality of control and performance trends for the two control systems were compared. Overall, the DDC system was found to maintain better control of the supply air temperature and to follow reset schedules more closely than the pneumatic system. One air-handling unit performed as well under pneumatic control as it did under DDC in maintaining a supply air setpoint, but it did not precisely follow the reset schedule. Each air-handling unit was found to have different performance characteristics while under pneumatic control, but all units behaved essentially the same under DDC. The results indicate that a pneumatic system can perform as well as a DDC system, but more effort is required to maintain system performance.

45271 **(PNL-SA—15756) Lung cancer risk models from experimental animals.** Gilbert, E.S. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 12p. (CONF-880329—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008181/JAW.

From 24. annual meeting of the National Council on Radiation Protection and Measurement; Washington, DC, USA (30 Mar 1988).

The objective of this paper is to present analyses of data based on methods that adequately account for time-related factors and competiting risks, and that yield results that are expressed in a form comparable to results obtained from recent analyses of epidemiological studies of humans exposed to radon and radon daughters. These epidemiological analyses have modeled the hazard, or age-specific death rates, as a function of factors such as dose and dose rate, time from exposure, and time from cessation of exposure. The starting point for many of the analyses of human data has been the constant relative risk modeling which the age-specific death rates are assumed to be a function of cumulative dose, and the risks due to exposure are assumed to be proportional to the age-specific baseline death rates. However, departures from this initial model, such as dependence of risks on age at risk and/or time from exposure, have been investigated. These analyses have frequently been based on a non-parametric model that requires minimal assumptions regarding the baseline risks and their dependence on age.

45272 **(STF—11A87040) Large heat pump systems with distribution at intermediate temperature.** Lorentzen, G.; Neksaa, P. (SINTEF, Trondheim (Norway)). Jun 1987. 14p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753729/JAW.

A fair number of large heat pumps up to 120 MW, feeding more or less conventional district heating networks, have been built in recent years. They give an important energy saving compared with traditional fuel heating. The system has some drawbacks, however, which can be eliminated by appropriate design: 1) An expensive, insulated double pipe system is required for the heat distribution. 2) If summer cooling is required, an additional two pipes will be needed, or alternatively separate cooling systems must be installed at the individual consumers. 3) Metering of the supply of heat and cold to the users requires expensive equipment, needing constant maintenance. 4) Most important, the system must work with an unreasonably high condensing temperature, as needed by the worst customer with an outdated central heating system. This reduces the coefficient of performance and makes it impossible to take advantage of the reduced temperature requirement of modern heating installations in new buildings. 7 drawings, 1 table.

45273 **(STF—11A87051) Heat pumps for domestic heating. Utilization of heat from soil and air.** Eggen, G. (SINTEF, Trondheim (Norway)). Aug 1987. 18p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753733/JAW.

The report concerns domestic heating, and presents a technical/economical evaluaton of the various types of small heat pumps. A comparison between the ground source and the air source is given, and the conclusion is: The more efficient ground source heat pumps decrease the energy consumption, but the profitability analysis proves the benecial use of air source heat pumps because of the decreased installation costs; the use of smaller air source heat pumps in big buildings seems to give beneficial conditions of increased operating time and profitability; the use of large heat pumps in industry and occupational buildings, shows a considerable lower demand of investment compared with all heat pump installations. 9 drawings, 6 tables.

45274 **Thermal and solar-optical properties of silica aerogel for use in insulated windows.** Hartmann, J.; Rubin, M.; Arasten, D. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp 42-47 of Proceedings of the 12th passive solar conference. Andrejko, D.A.; Hayes, J. Boulder, CO; American Solar Energy Society (1987). (CONF-870711—).

From Solar '87: 12th national passive solar conference; Portland, OR, USA (12 Jul 1987).

Silica aerogel is a porous insulating material that is transparent to solar radiation. To understand its insulating performance in a window system, it is necessary to first study component heat transfer paths. Aerogel's absorption coefficient, a measure of the attenuation of radiation heat transfer, was determined over the spectral range 1-200 μm. Although radiation heat transfer is negligible over much of this region, there is a transmission window between 3-6 μm. At ambient temperatures, for aerogel thicknesses of 0.5-5.0 cm, radiation heat transfer through an unmodified aerogel window is less than 15% of the total heat flux. For evacuated or high-temperature furnace windows, this contribution can be over 50%. Thermal radiative transfer can be somewhat decreased by allowing the aerogel to absorb moisture, but solar transmission and optical clarity are sacrificed. Absorption of water vapor over time causes irreversible structural changes that increase scattering in the solar spectrum. Aerogel's thermal performance can be improved by replacing the pore gas with one of lower conductivity or by evacuating the aerogel to pressures below 0.1 atm. A hypothetical evacuated aerogel window has a calculated U-Value of $\approx$ 0.5 W/m/sup 2/-K for a gap spacing of 12.5 mm, which is four times better than currently available low-emissivity gas filled units of similar size.

45275 **Light-well to atrium conversions: A case study investigating the daylighting issues.** Erwine, B. (Applied Science Div., Lawrence Berkeley Lab., Berkeley, CA (US)). pp 21-31 of Proceedings of the 12th passive solar conference. Andrejko, D.A.; Hayes, J. Boulder, CO; American Solar Energy Society (1987). (CONF-870711—).

From Solar '87: 12th national passive solar conference; Portland, OR, USA (12 Jul 1987).

This paper presents a case study approach to the investigation of the daylighting issues involved in the conversion of an existing light-well into an atrium. The study includes an evaluation of the effects on the natural light provided to the atrium floor and the adjacent spaces. The building studied is the John Radcliffe Hospital

in Oxford, England. The work is part of a larger project conducted by the Research in Building Group at the Polytechnic of Central London (PCL) investigating the overall issues (thermal, ventilation, daylighting, structural and programmatic) involved in the conversion of light-wells to atria. This daylighting study was conducted in three parts: 1) an analysis of the existing daylighting conditions in the light-well and adjacent rooms, 2) the construction of a scale model of the existing building for testing in the PCL artificial sky, and 3) the design and analysis of potential glazing systems for the retrofitted atrium.

3202 Transportation

45276 **(ANSP-M—18) Construction of the aerodynamics of the GPHS module for full rotational motion at subsonic speeds.** Lucero, E.F.; Barnett, J.C. (Johns Hopkins Univ., Silver Spring, MD (USA). Applied Physics Lab.). Sep 1986. Contract AI01-83NE32109. 75p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88012540/JAW.

The six-component subsonic static force and moment coefficients of the GPHS (General Purpose Heat Source) module and the pitch, yaw, a nd roll damping coefficients have been constructed in the full rotational range in angle of attack, α/sub R/, and roll angle, {phi}. The test data from various subsonic wind tunnel tests were used as the basis. These constructions are being used to generate a subsonic data set that is compatible with a BFD 6DOF reentry program that is being developed in parallel using the existing reentry program as the basis. The coefficients are given in graphical form for the full range in α/sub R/ and {phi} and as algebraic equivalences. These equivalences may be used to facilitate the formulation of the data set by making use of existing logic in available computing equipment. Test data which form the basis for the construction are also given. 11 refs., 31 figs., 5 tabs.

45277 **(PB—88-199179/XAB) Summary of the field compaction of asphalt mixtures in Texas. Research report (Final).** Kennedy, T.W.; Tahmoressi, M.; Anagnos, J.N. (Texas Univ., Austin (USA). Center for Transportation Research). Nov 1986. 170p. (CTR—3-9-82-317-2F). NTIS, PC A08/MF A01.

This report summarizes the asphalt density data which were obtained during the 1983 construction season from 17 construction projects in the State of Texas. The data were analyzed to determine the level of density and variation being achieved. Asphalt-content data were obtained for each project to study variations in asphalt-content during the construction process and determine the magnitude of deviation of extracted asphalt content from the design value. An evaluation of the adequacy of various density-determination techniques was conducted. Some Districts provided nuclear density data; an attempt was made to study the correlation between core and nuclear densities.

45278 **(PB—88-200027/XAB) Pavement evaluation and rehabilitation.** Ali, N.A.; Khosla, N.P.; Johnson, E.G.; Hicks, R.G.; Uzan, J. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 181p. (TRB/TRR—1117). NTIS, PC A09/MF A01.

Library of Congress catalog card no. 87-31308.

The 20 papers in this report deal with the following areas: determination of layer moduli using a falling weight deflectometer; evaluation of effect of uncrushed base layers on pavement performance; the effect of contact area shape and pressure distribution on multilayer systems response; sensitivity analysis of selected backcalculation procedures; performance of a full-scale pavement design experiment in Jamaica; subsealing and load-transfer restoration; development of a demonstration prototype expert system for concrete pavement evaluation; numerical assessment of pavement test sections; development of a distress index and rehabilitation criteria for continuously reinforced concrete pavements using discriminant analysis; a mechanistic model for thermally induced reflection cracking of portland cement concrete pavement with reinforced asphalt concrete overlay; New Mexico study of interlayers used in reflective crack control; status of the South Dakota profilometer; incorporating the effects of tread pattern in a dynamic tire excitation mechanism; external methods for evaluating shock absorbers for road-roughness measurements; factor analysis of pavement distresses for surface condition predictions; development of a utility evaluation for nondestructive-testing equipment used on asphalt-concrete pavements; estimating the life of asphalt overlays using long-term pavement performance data; present serviceability-roughness correlations using rating panel data; video image distress analysis technique for Idaho transportation department pavement-management system; acceptability of shock absorbers for road roughness-measuring trailers.

45279 **(PB—88-200035/XAB) Geotechnology.** Semenov, V.A.; Kennedy, T.W.; Smith, R.; Holmgreen, R.J.; Tahmoressi, M. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 160p. (TRB/TRR—1119). NTIS, PC A08/MF A01.

Library of Congress catalog card no. 87-34783.

The papers included in this Record deal with various facets of geotechnical engineering. The Record should be of use to those interested in the application of technology to highway transportation and researchers. The subjects covered by the papers include theoretical calculation of contact stresses in granulated materials in pavement; effect of soil characteristics on hydrated-lime and portland-cement treatments; use of portable data loggers, time-lapse movie cameras, acoustic-emission devices, analytical photogrammetry techniques, and microcomputer technology in work related to slope stability and landslides along highways; construction and instrumentation of high-approachment embankments for bridge crossings; determination of ultimate pull-out resistance of square vertical anchors in saturated clays; design, construction, and other aspects of soil nailing of retaining structures; experimental and analytical study of the behavior of 45-degree underreamed footings in a field environment; an alternate method of obtaining California bearing ratio values and moisture susceptibility of soils; effects of dilatometer penetration on soil parameters estimated from dilatometer data in sands; in-situ test methods that offer significant promise in evaluation of the properties of stiff soils; and case histories on the problems and solutions related to blasting and hazardous-rock stability conditions along highways.

45280 **(PB—88-200043/XAB) Effects of temperature and water on pavement performance.** Badu-Tweneboah, K.; Tia, M.; Ruth, B.E.; Richardson, J.M.; Armaghani, J.M. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 100p. (TRB/TRR—1121). NTIS, PC A05/MF A01.

See also PB—87-113304; Library of Congress catalog no. 87-34964.

The 12 papers in the report deal with the following areas: procedures for estimation of asphalt-concrete pavement moduli at in-situ temperatures; stress caused by temperature gradient in portland-cement concrete pavements; characterizing temperature effects for pavement analysis and design; temperature response of concrete pavements; an examination of environmental versus load effects on pavements; moisture in portland-cement concrete; effect of rainfall on the performance of continuously reinforced concrete pavements in Texas; effect of moisture on the structural performance of a crushed-limestone road base; water-induced distress in flexible pavement in a wet tropical climate; an evaluation of design high-water clearances for pavements; economic impact of pavement subsurface drainage; use of open-graded, free-draining layers in pavement systems; a national synthesis report.

45281 **(PB—88-201272/XAB) North Freeway Transitway: evaluation of the second year of barrier-separated operation. Research report (Interim) September 1983-March 1988.** Borchardt, D.; Ranft, S.E. (Texas A and M Univ., College Station (USA). Texas Transportation Inst.). Mar 1988. 76p. (TTI—2-10-84-339-12). NTIS, PC A05/MF A01.

See also PB—87-187605.

This report documents the second year's operation of the I-45 North Freeway Transitway in Houston, Texas. The second year covers the period from December 1985 to November 1986. A detailed discussion of the construction sequencing and traffic-control strategies implemented is also presented. Impacts to the freeway mainlane traffic are assessed through an analysis of travel times and speeds, vehicle and passenger flow rates, and freeway accident rates. Transitway operation is assessed through an analysis of high-

occupancy vehicle demand volumes and peaking characteristics, park-and-ride volumes, travel-time savings, occupancy rates, violation rates, disabled-vehicle incident rates, and a variety of other performance measures. Comparisons are made for the second year of transitway operation with that of the previous year.

45282 **(PB—88-202692/XAB) Estimating flexible pavement maintenance and rehabilitation fund requirements for a transportation network. Research report (Interim) September 1984-February 1988.** Stein, A.; Scullion, T. (Texas A and M Univ., College Station (USA). Texas Transportation Inst.). Feb 1988. 202p. (TTI—2-18-85-409-1). NTIS, PC A10/MF A01.

In the early 1980's the Texas State Department of Highways and Public Transportation implemented its Pavement Evaluation System. The system was designed to (a) document trends in network condition and (b) generate a one-year estimate of rehabilitation funding. The information generated by the system was used for many purposes including funding request, project prioritization and documenting the consequences of changes in funding levels. However, a limitation of the system was its inability to project future conditions and make multi-year needs estimates. This is the subject of the report. Regression equations were built for each major distress type from a pavement data base containing a 10-year history of condition trends from over 350 random sections in Texas. These equations were used to age individual sections that did not qualify for maintenance or rehabilitation in a particular year. A simple decision tree was developed to estimate the maintenance requirements if rehabilitation is not warranted. The decision-tree represents the opinions of experienced maintenance engineers. A case study and sensitivity analysis are presented.

45283 **(UCID—21443) Review of the space shuttle propulsion pressurization system probabilistic risk assessment.** Wells, J.E.; Johnson, G.L. (Lawrence Livermore National Lab., CA (USA)). 24 Jun 1988. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013163/JAW.

Lockheed Missiles and Space Company, Inc. has performed a probilistic risk assessment of the space shuttle main propulsion pressurization system for NASA. A draft report of the assessment was completed in mid September 1987. We at the Lawerence Livermore National Laboratory (LLNL) were asked by NASA to perform an independent peer review of that risk assessment. This review assessed whether the analysis was done consistent with currently used methods for doing such analyses, pointed out deficiencies found in the analysis, and evaluated how these deficiencies affected the final result.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 44607, 44854, 44873, 44939, 45095, 45122, 45226, 45236, 45237, 45665

45284 **(DOE/ID/12557—2) Development of a prototype ultraviolet absorption hygrometer for industrial dryers: Phase 2: Final report.** Gersh, M.E.; Domingue, R.P.; Matthew, M.W.; Richtsmeier, S.C.; Bangert, M.; Lowe, R. (Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office; Special Sciences, Inc., Burlington, MA (USA); Pacer Systems, Inc., Billerica, MA (USA)). Jun 1987. Contract FC07-85ID12557. 59p. (SSI-TR—123). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88011631/JAW.

The motivation for this program is the observation that the use of reliable and accurate hygrometers to monitor or control the processes in industrial drying chambers could result in a significant reduction in the energy usage of the United States. At the present time, there are no commercially available hygrometers which have the required characteristics of a measurement capability at simultaneously high temperature and humidity, along with the ability to operate for long periods in a severely contaminating and/or particle-laden environment. The goal of this program is the development of an industrial hygrometer which can be employed to monitor the humidity during industrial drying operations. This requires a device which can operate at temperatures up to 250C, at high humidity (50-100%), and in environments containing particulates and/or fouling or corrosive vapors. 9 refs., 23 figs.

45285 **(NLVF/S—682) Energy recovery from the outbuildings for animal husbandry. Final report.** Storeheier, K.J.; Lilleng, H. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Jan 1987. 10p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88753710/JAW.

The report presents the main conclusion from the project on energy recovery from the outbuildings of animal busbandry. The aim of the project was to investigate the advantaging - or limiting factors concerning the use of ventilating air in cowsheds or the like, and to increase the efficiency and reliability of the equipment. New approaches are briefly discussed. 2 drawings, 23 references.

45286 **(NP—8770236) Development and testing of a process heat generator system, phase II. Development and testing of a process heat generator system, oil-free compressed air.** Nguyen, N.V. (Gesellschaft fuer Technische Studien, Entwicklung, Planung G.m.b.H. (SEP), Muenchen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1987. 131p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770236/JAW.

Dry running screw compressors (type VM of Aerzener Maschinenfabrik) to generate oil-free compressed air up to 3.5 bar above atmospheric were modified for steam compression and for generation of oil-free compressed air up to 9 bar by integration of a water injection device and by variation of the labyrinth box. To realize higher pressure ratios at the steam compression two compressors were connected in series (this is possible without problems for the line VM by a common primary shaft). Pressure ratios between 2 and 10 with suction pressures from 0.9 to 3.6 bar were investigated. For pressure ratios of more than 5 the specific energy consumption for the two-stage compression is less than for the one-stage compression. By water injection in the range between 0.12 and 0.24 liter per m/sup 3/ intake air compressed air was generated with pressures between 6 and 9 bar and temperatures between 140 and 180/sup 0/C. The compressor COP is considerably higher compared to the uncooled one-stage compression because of the cooling by water injection and a little less compared to the two-stage compression with intercooler. (orig.) With 6 refs., 3 tabs., 51 figs.

45287 **(STF—11A87045) Investigation of air/airsource heat pumps in greenhouses.** Eggen, G.; Jonassen, O. (SINTEF, Trondheim (Norway)). Jul 1987. 22p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753732/JAW.

The report presents an investigation done on the use of air source heat pumps for the heating of greenhouses at Rennesoey in the county of Rogaland (Norway). A cost comparison is given for a system of oil-heating and the heat pump system mentioned. The payback of investment seems to be well within the period of four years. 7 drawings, 2 tables.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 44846, 44912, 44997, 45251, 45260, 45272, 45665

45288 **(CONF-8705301—Exc.) Waste through the ages.** (Verband Kommunaler Staedterainigungsbetriebe, Koeln (Germany, F.R.)). 1987. 76p. (In German, English and French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).

The lectures given at the symposium deal with questions of municipal cleansing and waste disposal. They discuss historical aspects of waste disposal and the problems in store for an exponentially growing world population in the sectors of environmental protection and waste disposal. Five papers are separately recorded. (EF)

45289 (CONF-8705301—Exc., pp 34-40) **Waste management - state of matters and new tasks.** Schenkel, W. (Umweltbundesamt, Berlin (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).
Verband Kommunaler Staedtereinigungsbetriebe e.V. (VKS). Dokumentation.; No. 2/87.

Future waste management will strive for adapted solutions. Local and regional conditions will have a stronger influence on waste avoidance and waste recycling than on waste disposal. There will not be a single, correct solution, but a web of many viable, interlinked solutions will exist, as ecological system theory teaches us. Waste avoidance, recycling, and disposal will form an integrated whole, having considerable repercussions on collecting and transport systems as well as on the organizations in charge. (orig./EF)

45290 (CONF-8705301—Exc., pp 41-45) **Waste treatment processes as a source of environmental pollution.** Hansen, J.A. (Aalborg Universitetscenter (Denmark). Dept. of Environmental Engineering). 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).
Verband Kommunaler Staedtereinigungsbetriebe e.V. (VKS). Dokumentation.; No. 2/87.

The concepts pollution, risk and technology are discussed with regard to choice of rational goals for equipment, performance and operation of waste treatment processes. Particular concern is related to the term 'best available technology' which does not offer a rational solution for choice of equipment and performance in waste treatment. A need is expressed for more work on the conceptual approach when setting goals, standards, criteria and control procedures for environmental protection. Incineration is used as an example of a waste treatment process that is used widely. Given economical means there is little doubt that operation can be made to meet even very strict emission criteria. The open question is what such criteria should be to satisfy demands for environmental protection. Recycling may be but one useful element in a combined effort to limit environmental pollution related to waste management. (orig.)

45291 (CONF-8705301—Exc., pp 46-53) **Strategies to reduce the share of pollutants in waste.** Tabasaran, O. (Stuttgart Univ. (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).
Verband Kommunaler Staedtereinigungsbetriebe e.V. (VKS). Dokumentation.; No. 2/87.

Pollutant levels in municipal wastes can be reduced by removing the relative constituents from waste after collection or by separate collection of hazardous materials. The paper tries to quantify pollutant levels in the individual material groups of waste and to point out ways for their retrieval. (orig./EF)

45292 (CONF-8705301—Exc., pp 54-64) **Experience gathered with waste disposal in a regional agglomeration.** Knobloch, W. (Stadt Essen (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).
Verband Kommunaler Staedtereinigungsbetriebe e.V. (VKS). Dokumentation.; No. 2/87.

Out of some 560 000 tonnes of waste, which is the total amount produced per annum, some 40 000 to 50 000 tonnes p.a. will have to be dumped as residual matter, given the present state of things. This means the amount to be dumped will be less than 10% of the original amount, and consequently dumping space will be carefully used. For the latter reason alone, waste combustion in agglomerations like the Ruhr zone will also in future continue to be the most reliable way of disposing of solid materials. The tie-in of five cities to the waste combustion plant at Essen-Karnap assures a reasonable economic result. (orig.)

45293 (CONF-8705301—Exc., pp 65-69) **Liability for damage caused by waste disposal and compensation for damage.** Gosch, J. 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770239/JAW.

From International ISWA/VKS symposium: waste through the ages; Muenchen, F.R. Germany (20 May 1987).
Verband Kommunaler Staedtereinigungsbetriebe e.V. (VKS). Dokumentation.; No. 2/87.

In the framework of this treatise, aspects of waste disposal are examined for possible liabilities involved. Those liabilities being with the collection of waste, continue as it is recycled, processed, and burned, and do not even cease when waste is dumped on a landfill. Sanitary landfills may involve considerable liabilities from possible hazards to ground water. (orig./EF)

45294 (DOE/CE/26549—T1) **City of Kansas City, Missouri, Public Works Department: Solid waste management plan, district heating and cooling plan, and waste-to-energy feasibility study.** (Burns and McDonnell Engineering Co., Kansas City, MO (USA)). 1988. Contract FG01-86CE26549. 550p. NTIS, PC A23. Order Number DE88011892/JAW.

A comprehensive analysis of federal, state, and local laws and regulations determined that Kansas City, Missouri exercises a great deal of control over solid waste collection, transportation and disposal, including the right and power to impose mandatory collection service and fees. In addition, Kansas City may enter into long-term contracts with other cities, both in Missouri and in other states, to receive wastes, provided the contractual arrangements do not incur long-term debt for the city. Commercial and industrial waste was found to be currently not under the control of Kansas City, Missouri; however, it could be brought under the city's control with amendments to the City Ordinance. 35 figs., 70 tabs.

45295 (ORNL/TM—10484) **Power generation from waste incineration.** Kolb, J.O.; Wilkes, K.E. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 117p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88012162/JAW.

Incineration of municipal solid wastes (MSW) with heat recovery for power generation is being used increasingly in the US to reduce the volume of wastes to be landfilled. High-temperature incineration is also beginning to be used to decontaminate sites where hazardous chemicals were disposed of in the past with large amounts of heat usually wasted in such incinerators. This report presents a characterization of MSW incineration technologies, an energy market evaluation in the DADS area, an evaluation of energy recovery from waste tires, a conceptual design of an integrated incineration power plant, and an economic analysis of hazardous waste processing costs and potential savings with an integrated facility. Analyses of the amount and types of hazardous wastes, appropriate incineration technologies, a process design to size flue gas heat recovery equipment, and cost estimates for hazardous waste incinerator systems and heat recovery equipment were performed by Science Applications International Corporation (SAIC) in a companion study and used in this report. The primary conclusion of this study is that processing cost savings with an integrated waste incinerator power plant range from 6 to 20% of costs compared to separate hazardous waste incineration. However, this result depends on the amount and moisture content of the waste material and the electricity value sold to the local utility. Other results and conclusions include the types of hazardous waste incineration technologies recommended, the market for energy products, and institutional restraints and requirements. 32 refs., 17 figs., 20 tabs.

45296 (STEV—1987-2) **Temperature levels in district heating and block central systems.** (Statens Energiverk, Stockholm (Sweden)). Dec 1986. 120p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88753722/JAW.

The possibilities to lower the operational temperatures in district heating systems are examined in this report. In practise it is not possible to pinpoint an optimum temperature for a district heating system, but it is found that a general reduction of the tempera-

ture is desirable. Such a reduction can give lower space heating costs, especially for systems based on combined heat and power production and heat pump systems. The effects for increased power production will only be marginal. (G.B.).

45297 **(STEV—1987-R6) IEA District Heating. Technical and economic assessment of new distribution technology.** (Statens Energiverk, Stockholm (Sweden)). May 1987. 80p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753724/JAW.

The comparison analyses the construction of networks from a technical and economic point of view. 4 flexible pipe systems with plastic medium pipes are considered. These systems are considered to be particularly promising from a cost point of view. They were assessed for the limits of their technical usability and construction costs and compared with systems which have already been used for many years. Results show that basically the systems seem to be applicable up to temperatures of about 90/sup o/ C and pressures up to 5-6 bar. However, the investigation also showed that the technical properties of plastic medium pipe systems have been developed in different directions. None of the investigated systems corresponds to to-days available state of the art. At present the economic incentive for the application of plastic medium pipes is only small, as the KMR technique is not much more expensive. However, it can be said that for larger turnovers the price of plastic medium pipes could be reduced still further as it would then be likely that more efficient production methods could be employed. Improvements in the construction and assembly would also be possible. For these reasons it would be worthwhile developing the systems further.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 45325, 45327, 45328, 45538

45298 **(AD-A—192280/6/XAB) Pulsed spray structure and atomisation techniques. Final report, November 1983-August 1987.** Yule, A.J. (Manchester Univ. (UK). Dept. of Mechanical Engineering). Aug 1987. 31p. NTIS, PC A03/MF A01.

The process of atomisation from diesel injectors is found to persist for a significant proportion of the spray length before impaction on the cylinder wall. Both aerodynamic shear and cavitation appear to be of importance for the liquid-jet breakdown. In addition, cyclic variations are found in the atomisation and penetration of sprays. The transient nature of the spray initial conditions can cause pile-up and coagulation of droplets at the leading edge of the spray pulse for certain cases. Improved modeling of diesel injection requires recognition of these phenomena and this is supported by both modeling and experimental data which have been obtained under realistic engine conditions in a specially developed rig.

45299 **(AD-A—192835/7/XAB) Analytical and experimental investigation of ringless-piston concept. Interim report, September 1986-December 1987.** Dickey, D.W.; Wood, C.D. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1987. 57p. (BFLRF—247). NTIS, PC A04/MF A01.

The purpose of this project was to analytically and experimentally investigate the concept of a ringless-piston internal-combustion engine. A joint objective was to design, build, and test a ringless piston to improve ringless-piston engine performance. A computer model was developed to predict ringed and ringless-piston engine performance. Experimental performance data were then collected by operating a small, liquid-cooled, two-stroke gasoline engine with and without the piston ring on the stock aluminum and Southwest Research Institute prototype steel piston. The experimental performance data were then compared with the results of the computer model. The results showed that a piston engine can operate without piston rings.

45300 **(DOE/CE/15274—T1) "Charlie{reg←sign}" prototype development and open road testing: Final report.** (Camacan, Inc., Denver, CO (USA)). [1987]. Contract FG01-86CE15274. 104p. NTIS, PC A06. Order Number DE88012154/JAW.

CHARLIE is a patented electronic instrument that works in conjunction with brake retarders. Charlie automatically controls the amount of torque transferred from the engine to the wheels by sequentially bringing in two cylinders of power at a time. This creates a smooth transition of power as opposed to the sudden jolt. This smooth transition of power causes less wear and tear on the engine, drive train, and vehicle. The system also caused the wheels to be 3.5 times more efficient in terms of wheel slippage on wet and dry surfaces. Charlie also eliminates engine lockup through a patented sensor system. Charlie also potentially saves fuel. On September 30, 1986, Camacan, Inc., the owner of the patent rights to Charlie, received a DOE sponsored grant to test for a patent claim, FUEL SAVINGS. The results are included in the following pages. Also included are the results of a separate DOE sponsored grant which tested Charlie for wheel slippage. 5 refs., 30 figs.

45301 **(EUR—11186) Gas flow and global code programme: Summary report, 1 April 1985-31 March 1986.** Benjamin, S.F. (Commission of the European Communities, Luxembourg; Gaydon Technology Ltd., Warwick (UK)). Feb 1987. 18p. NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012635/JAW.

This contract (Contract 2) forms a bridging programme between contract EE.CI.210 UK(H) (1.3.83 - 31.12.84) (Contract 1) entitled "The development and evaluation of three dimensional models of cold flow in in internal combustion engines" and proposal EN3 E/CI/041 GB (Contract 3) entitled "Basic Gas Flow Code for Reciprocating Engines" (planned start date 1.4.86). The objectives of these programmes are to develop a series of computer codes capable of simulating the in-cylinder flow and turbulence fields in reciprocating engines. This programme involves both computational work for the construction of the computer codes along with an experimental programme aimed at providing flow measurements for code evaluation. During the contract period problems were encountered with the MICE code. An earlier development code 'EPISO', on which MICE was based, was therefore used as the basis for continued refinement, and to support the first steps in the development of the SPEED code. A combustion module has been incorporated into EPISO. Development of the SPEED code has met the interim objectives, so that this work is on schedule for release of the first version (Code 1) at the end of 1986. The experimental programme has largely concentrated on the development of hardware necessary for the high speed laser doppler anemometry measurements that are to be obtained as part of the ongoing programme. Testing of the mechanical and electronic hardware for the high speed model engine system is complete. Measurements have been obtained from an idealised port under steady state conditions prior to incorporation on the model engine.

45302 **(NAL-TR—932) Flow patterns induced by vortices.** Nishimura, Hideaki. (National Aerospace Lab., Chofu, Tokyo (Japan)). May 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753876/JAW.

It is very important to calculate the flow loss in a cascade along with the advance of the gas turbine performance. The placement of vortics determines the configuration of the calculation region where vortics exist and when located in a confined region, vortics form a flow field in the region of mutual interferance. The flow field obtained is very useful to analyze the secondary flow in a casecade. Three flow patterns such as a parallelogram bounded by four boundaries, a channel restricted by upper and lower boundaries and a half region confined by upper, lower and left boundaries, were calculated by using the elliptic functions and hyperbolic functions. From these results, it was found that this method can be used as a method to understand and analyze interference phenomena of vortics of the secondary flow in a three dimensional cascade. It is important to find correctly functional values in many applicating calculation using the elliptic functions. The nature of Weierstrauss's elliptic functions and the numerical calculation method are presented in the appendix. (21 figs, 9 refs)

45303 **(NAL-TR—938) Error evaluation of some practical thermocouple probes for gas turbine combustor tests.** Tamaru, Takashi; Shimodaira, Kazuo. (National Aerospace Lab., Chofu, Tokyo (Japan)). Jul 1987. 23p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753877/JAW.

Thermocouple rakes in which Pt sheathed thermocouples can be measured correctly without any deterioration under high temperature, pressure and humid environment were designed. The thermocouples have high operatablity so that they can easily be inserted into 20mm hole. Representative thermocouple rakes including this thermocouple, were experimented to verify the precision in the field where the radiation and conductivity influenced simultaniously. Experiments were carried out at conditions of 400 to 1,000°C and in a cooled jacket duct where the combusted gas flowed at velocities of 26-130m/s. The new designed thermocouple has lower error due to conditions of sheath and others and the influence of location difference can be neglected. It was found that the thermocouple rake of multipoints could represent comprehensively the influence of the temperature of main and rapid flow and the wind velocity nondimensionally and can represent numerically the influence of radiation exchange with the periphery. (25 figs, 9 tabs, 17 refs)

45304 **(NEI-SE—16) Natural gas powered vehicles. Progress report - Program proposal State Power Board RDandD 1987.** Carlqvist, T. (Swedish State Power Board, Vaellingby). 19 Dec 1986. 66p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753705/JAW.

Headings: A. Progress report; 1.Utilization of natural gas in vehicles over the world. 2.Gas utilization in vehicles in Sweden. 3.Natural gas technique in vehicle propulsion. 4.Economy of natural gas technique in vehicle propulsion. 5.Environmental benefits of natural gas technique in vehicle propulsion. B. Program proposal; 1.International retrieval and evaluation of technique, economics and environment valid for vehicle propulsion by natural gas. 2.Natural gas powered vehicles demonstration projects. 3.Swedish research and development programs for NGV-technique. 4.Aim of the 1987 RD and D program. 5.Aim and direction. List of references. Appendices.

45305 **(NP—8770279) Comparative investigations of conventional and electronically controlled fuel injection systems for a direct-injection diesel engine with wall application of fuel.** Wenzlawski, K. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 10 Feb 1987. 159p. (In German). NTIS (US Sales Only), PC A08. Order Number DE88770279/JAW.

After outlining the state of the art of fuel injection systems, the author lists demands on fuel injection systems and describes fuel injection systems with electric and electronic control. The experimental set-up and procedure are described, as are the measurement of cylinder pressure and overall pressure level, the supply line and injection curve, and thermodynamic aspects. The functional characteristics of the two different types of fuel injection systems are compared, engine performance data are presented, and data on the pressure curve, thermodynamic processes, heat release (as a function of the crank angle) and injection point variations (different system pressures) are given. Electronic control improved the performance of diesel engines. (HWJ).

45306 **(NP—8770284) Conception and analysis of a direct-injection, alcohol-fuel, stratified-charge engine.** Weissermel, V. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 16 Jan 1987. 219p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770284/JAW.

The author investigated the applicability of alcohol fuels in small diesel engines with modified combustion chamber configuration and with spark plugs. A thermodynamic analysis was carried out for the mixing and combustion processes with alcohol fuel. Preparatory activities, experiments (parameters, basic experiments with diesel fuel and methanol, ignition problems), and methods of evaluation and calculation for process analysis purposes are gone into. Finally, the experimental results of diesel fuel, methanol and ethanol are compared. The possibility of applying the engine concept to a 4-cylinder, full-scale engine is discussed. (HWJ).

45307 **(NP—8770322) Glass-fibre laser-Doppler anemometer for measurements inside internal combustion engines.** Krebs, H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Technische Fakultaet). 31 Oct 1986. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770322/JAW.

Quantitative measurements of the high-turbulence fluid flow conditions inside internal combustion engines are carried out most efficiently using laser-Doppler anemometry. This technique uses coherent laser light; it is direct, free of interferences and requires no transducers which would be susceptible to wear. Flow velocities can be measured during combustion and at high flow pressures and velocities. After otulining the problems of engine research, the author reviews the state of the art of flow velocity measurement inside internal combustion engines, the fundamentals of measurement (design and calculation principles), and the dual-probe LDA system with electronic signal processing used in the measurements. The LDA system was used on two test benches, one with a fired spark ignition engine and the other with a dragged diesel engine. The measurements and results are gone into. (HWJ).

45308 **(NP—8770332) Investigations of direct combustion noise in a single-cylinder diesel engine.** Schluender, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 9 May 1986. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770332/JAW.

The author investigated the possibility of noise reduction by primary measures in a single-cylinder diesel engine. The acoustic transfer constant was first determined in model combustion chambers. Excitation spectra were measured at various points inside the combustion chamber. Pressure variations (spatial resonances, excitation of vibrations), acoustic characteristics of the cylinder pressure curve (spectra), and the acoustic transfer constant (separation of noise components, combustion process) were determined. It was found that combustion control measures will minimize cyclic noise level variations in the excitation spectrum, so that noise levels may be reduced by up to 3dB. (HWJ).

45309 **(PB—88-198197/XAB) Application for certification, 1988 model year light-duty vehicles.** (Environmental Protection Agency, Washington, DC (USA)). 1988. 11982p. NTIS, PC E99/MF E99.

Set includes PB—88-198205 through PB—88-198254.

A separate abstract is included for each of six reports of the set that are included here.

45310 **(PB—88-198205/XAB) Application for certification, 1988 model year light-duty vehicles - BMW.** (BMW of North America, Inc., Montvale, NJ (USA)). 1988. 890p. NTIS PC$104.00/MF$18.50.

See also PB—88-198213, and PB—86-135803; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45311 **(PB—88-198213/XAB) Application for certification, 1988 model year light-duty vehicles - Chrysler motors.** (Chrysler Corp., Detroit, MI (USA)). 1988. 3022p. NTIS PC$332.50/MF$29.50.

See also PB—88-198221, PB—88-198205 and PB—87-141677; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45312 **(PB—88-198221/XAB) Application for certification, 1988 model year light-duty vehicles - General Motors.** (General Motors Proving Ground, Milford, MI (USA)). 1988. 2154p. NTIS PC$240.50/MF$25.00.

See also PB—88-198239, PB—88-198213, and PB—87-141693; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45313 **(PB—88-198239/XAB) Application for certification, 1988 model year light-duty vehicles - Isuzu.** (Isuzu Motors America, Inc., Southfield, MI). 1988. 561p. NTIS PC$71.50/MF$17.00.

See also PB—88-198247, PB—88-198221, and PB—86-135845; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45314 **(PB—88-198247/XAB) Application for certification, 1988 model year light-duty vehicles - Nissan.** (Nissan Motor Co. Ltd., Yokohama (Japan)). 1988. 2452p. NTIS PC$270.50/MF$26.50.

See also PB—88-198254, PB—88-198239, and PB—87-141743; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45315 **(PB—88-198254/XAB) Application for certification, 1988 model year light-duty vehicles - Volkswagen, Audi.** (Volkswagen of America, Inc., Ann Arbor, MI). 1988. 2903p. NTIS PC$320.50/MF$29.00.

See also PB—88-198247 and PB—86-135787; Also available in set of 6 reports PC E99/MF E99, PB—88-198197.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45316 **(PB—88-198262/XAB) Application for certification, 1988 model year heavy-duty vehicles.** (Environmental Protection Agency, Washington, DC (USA)). 1988. 1837p. NTIS, PC E99/MF E99.

Set includes PB—88-198270 through PB—88-198338.

A separate abstract is included for each of six reports of the set that are included here.

45317 **(PB—88-198270/XAB) Application for certification, 1988 model year heavy-duty vehicles - Chrysler.** (Chrysler Corp., Detroit, MI (USA)). 1988. 230p. NTIS PC$38.00/MF$17.00.

See also PB—88-198270 and PB—87-141628; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vechile parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45318 **(PB—88-198296/XAB) Application for certification, 1988 model year heavy-duty vehicles - Ford Motor Company.** (Ford Motor Co., Dearborn, MI (USA)). 1988. 501p. NTIS PC$65.50/MF$17.00.

See also PB—88-198288, PB—88-198304, and PB—88-125182; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives

a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45319 **(PB—88-198304/XAB) Application for certification, 1988 model year heavy-duty vehicles - Isuzu.** (Isuzu Motors America, Inc., Southfield, MI). 1988. 289p. NTIS PC$44.00/MF$17.00.

See also PB—88-198296, PB—88-198312, and PB—83-196303; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45320 **(PB—88-198312/XAB) Application for certification, 1988 model year heavy-duty vehicles - Mack truck.** (Mack Trucks, Inc., Hagerstown, MD (USA)). 1988. 336p. NTIS PC$49.00/MF$17.00.

See also PB—88-198304, PB—88-198320, and PB—85-186393; Also available in set of 7 reports PC E/99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45321 **(PB—88-198320/XAB) Application for certification, 1988 model year heavy-duty vehicles - Mitsubishi.** (Mitsubishi Motors Corp., Tokyo (Japan)). 1988. 120p. NTIS PC$27.00/MF$17.00.

See also PB—88-198312, PB—88-198338, and PB—87-141636; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also provided on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45322 **(PB—88-198338/XAB) Application for certification, 1988 model year heavy-duty vehicles - Navistar.** (Navistar International Corp., Melrose Park, IL (USA)). 1988. 76p. NTIS PC$23.00/MF$17.00.

See also PB—88-198320, and PB—87-141644; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. Information is also included on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

3302 External Combustion Engines

45323 **(CONF-8804100—21) An overview of the Stirling engine heat pump program.** Chen, F.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03. Order Number DE88013833/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

The paper summarizes the recent developments in the Stirling engine-driven heat pump program activities sponsored by the Department of Energy (DOE) through Oak Ridge National Laboratory (ORNL). This technology has displayed its ability to meet the thermal performance objectives. Enhance technology options guided by value engineering principles are being pursued toward the development of an economically viable household engine-driven heat pump. 12 refs., 10 figs., 2 tabs.

45324 (NEDOJ—8703, pp 322-350) **Research and development of swash plate type Stirling engine for air conditioning in power range of 10-100kW.** Momose, Yutaka. (Aisin Seiki Co., Ltd., Aichi, Japan). 22 Sep 1987. (In Japanese). NTIS (US Sales Only), PC A23. Order Number DE88754193/JAW.

In Proceedings of parallel sessions for the 7th NEDO general assembly.

This report deals with results of studies made in 1986 as part of research and development of Stirling engines for air conditioning in the power range of 10-100 kW. An effort is made to decrease the size (to 210 kg), while keeping the efficiency at 33.8 percent, the figure reached in the previous year. This is accomplished as a result of the development of a compact air heater of a decreased size (with volume decreased by 50%), burner of a increased efficiency, heat exchanger with optimized characteristics, and fin to be provided on the flame side to accelerate thermal radiation. To improve sealing, the oil scraper for the rod seal system is modified and a piston ring composed of step cut members is adopted. In pursuit of optimum application of the engine to other systems, some improvements including modifications in a swash plate type compressor have resulted in an air conditioner with performance coefficients of 1.03 and 1.48 at 1,000 rpm for cooling and heating, respectively, approaching the target values. Studies seeking fuel diversification have shown that a shaft output of 3 kW can be obtained by increasing the heat input (above 1,000°C) to a gassified wood fuel combustor or a heat pipe type heater.(39 figs, 13 tabs, 6 photos)

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 45229

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 45229

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 45300

45325 **(NP—8770219) Trial of noise-reduced diesel-powered vehicles in practical use. Final report.** Haerting, W.; Voehringer, W.; Horn, G.; Fietz, P.; Burkhardt, H. (Daimler-Benz A.G., Stuttgart (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). May 1985. 96p. (In German). NTIS (US Sales Only), PC A05. Order Number DE88770219/JAW.

Within the framework of the Bad Reichenhall model 20 diesel-powered taxis, model 240 D, and 8 short distance distribution vehicles, model L 508, have been built, tested under practical conditions and monitored with regard to their long-term noise emission characteristics. (orig.) With 19 tabs., 29 figs., 3 refs.

45326 **(NP—8770328) Factors contributing to the formation of depositions on the inlet valves of internal combustion engines.** Schommers, J. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 8 Jul 1986. 123p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770328/JAW.

The requirements of low fuel consumption, low emissions, and low production cost have caused coke deposition problems in reciprocating-piston internal combustion engines for motor vehicles. In order to investigate these deposition processes, the author determined the influence of engine parameters such as the oil volume at the valve shaft, crankcase ventilation, internal exhaust recirculation, valve temperature and mixture preparation under constant boundary conditions (especially fuel and lube oil composition) on a test bench. After outlining the state of knowledge on deposition formation conditions, the author explains the experimental programme and presents some results. A reproducible method of forming deposition, the growth with time of depositions, the influence of lube oil consumption, the mixing system, valve temperatures, the influence of the air ratio, morphology, deposition formation, and surface influences are gone into. (HWJ).

3307 Emission Control

REFER ALSO TO CITATION(S) 45309, 45310, 45311, 45312, 45313, 45314, 45315, 45316, 45317, 45318, 45319, 45320, 45321, 45322

45327 **(PB—88-198288/XAB) Application for certification 1988 model year heavy-duty vehicles - Detroit diesel.** (General Motors Corp., Detroit, MI (USA). Detroit Diesel Engine Div.). 1988. 285p. NTIS PC$43.50/MF$17.00.

See also PB—88-198270 and PB—88-198296; Also available in set of 7 reports PC E99/MF E99, PB—88-198262.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines the author intends to market during the upcoming model year. These engineering data include explanations and/or drawings that describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission-control systems. It also provides information on emission test procedures, service-accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

45328 **(PB—88-198734/XAB) Calculation of emissions from UK petrol-engined motor vehicles.** Eggleston, H.S. (Warren Spring Lab., Stevenage (UK)). Sep 1987. 61p. (LR—612(AP)M). NTIS, PC E06/MF E06.

This report describes the methods used to calculate emissions of sulfur dioxide, nitrogen oxides, volatile organic compounds and lead from UK petrol-engined motor vehicles. Techniques account for speed-related factors, traffic activity factors, and evaporative emissions. Results are shown for the years 1981 to 1984. The problems encountered extending the estimates, both backwards in time and into the future, are discussed. Estimates of emissions of nitrogen oxides, carbon monoxide, and hydrocarbons from 1973 to 2010 are presented for a variety of assumptions.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 45304

35 ARMS CONTROL

45329 **(AD-A—192083/4/XAB) Concept development and analysis of the environmental control, chemical protection, and power-generation systems for the battalion aid station and division clearing station. Final report, 5 June 1985-31 March 1986.** Lawrence, L.G.; McGrath, M.V.; Tanner, J.D. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 31 Mar 1986. 101p. (VSE/ASG—0169-86/10RD). NTIS, PC A06/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

The U.S. Army Natick Research, Development and Engineering Center (NRDEC) is developing new Battalion Aid Stations (BAS) and Division Clearing Stations (DCS). A DCS will be twice the size of a BAS, as it will most likely consist of two interconnected BAS shelters. NRDEC requires that BAS shelter utilities be packaged to fit onto the U.S. Army M101A1 3/4-ton cargo trailer. The U.S. Army Belvoir Research, Development and Engineering Center (BRDEC) is developing the environmental control, chemical protection, and power-generation systems (utilities) to be used with BAS/DCS shelters. Principal conclusions and recommendations presented in this report are (1) All BAS shelter utilities can be packaged to fit onto M101A1 cargo trailer, (2) The cargo trailer will require specific weight reduction modification to remain within the full load cross-country weight of 2840 pounds. In its new design concept, the load capabilities of the M101A1 cargo trailer will not support all required DCS utilities due to increased DCS utility loads, and equipment size and weights, 4) BRDEC should proceed with the BAS utility package and trailer modification, and (5) BRDEC should further analyze and accurately determine utility loads, and equipment sizes and weights to be trailer-mounted.

3501 Policy, Negotiations, And Legislation

45330 **(AD-A—192341/6/XAB) Strategic Defense Initiative - strategic implications. Study project.** Russell, T.L. (Army War Coll., Carlisle Barracks, PA (USA)). 31 Mar 1988. 41p. NTIS, PC A03/MF A01.

In March 1983, during this address to the nation, President Reagan initiated a major shift in U.S. strategic policy, as he indicated his desire to move away from the condition of mutual vulnerability as the primary deterrent to nuclear war. The Strategic Defense Initiative (SDI), as the vehicle for this shift, has become the focus of debate over implications of a new strategic policy. This study seeks to examine the strategic relationship, and the role of arms control during a transition from an offensive-dominant strategy to a defensive-dominant strategy. The methodology for the study is to present arguments for and against SDI, as they relate to the issues of stability and arms control, evaluate their validity, draw conclusions, and provide recommendations that may enhance international security during a transition period of SDI.

45331 **(AD-A—192351/5/XAB) Strategic forecast: US Navy beyond the year 2000. Phase 3. The role of the Navy as an instrument of national policy. Final report, 23 September 1986-22 July 1987.** Carpenter, W.M.; Foster, R.B.; Gilbert, S.P.; Kintner, W.R.; Twitchell, H.A. (SRI International, Arlington, VA (USA). Strategic Studies Center). Sep 1987. 238p. (SSC-TN—2689-1). NTIS, PC A11/MF A01.

Contents include: The Future Strategic Environment; The Future of the U.S. Alliance System; Future Nuclear Strategy Deterrence, and Arms Control; Future Conventional War; Low-Intensity Conflict in the Future; Conclusions; Appendix A: U.S. Navy Brown Water Capabilities for Central American Operations.

45332 **(AD-A—192415/8/XAB) Support of NATO strategy in the 1990's.** Carlucci, F.C. (Department of Defense, Washington, DC (USA)). 25 Jan 1988. 57p. NTIS, PC A04/MF A01.

Report to the United States Congress in compliance with Public Law 100-180.

This report concerns U.S. and allied planning for the future security posture of the North Atlantic Treaty Organization. It responds to the Congressional request (spelled out in the Appendix) that the Secretary of Defense discuss how Intermediate-Range Nuclear Forces (INF) missile reductions fit with NATO objectives and how they relate to the Alliance's flexible response strategy. In so doing, the report reflects consultation with NATO's Supreme Allied Commander, Europe (SACEUR) and the Chairman of the Joint Chiefs of Staff. It concludes seven supporting sections matched to specific questions from the Congress. This Overview discusses these important matters involving flexible response, defense requirements, arms control, and developing programs. All involve issues integral to the support of NATO and America's overall strategy -- aimed at bolstering deterrence, strengthening our alliances, and decreasing Soviet military advantages.

45333 **(AD-A—192800/1/XAB) Role of air base operability in tactical missile defense. Student report.** Fleet, S.A. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 46p. (ACSC—88-920). NTIS, PC A03/MF A01.

The emergence of a new generation of Soviet short-range, conventional, tactical ballistic missiles (FRGO, SS-1, SS-12, SS-21, SS-22, SS-23) threaten US/NATO air bases in Central Europe. The US has initiated a comprehensive, long-term Tactical Missile Defense (TMD) Program to counter the threat. At the same time, the USAF has re-focused attention on the need to improve air base survivability through it Air Base Operability (ABO) Program. This research paper examines the threat, discusses the concepts and realities of TMD, and analyzes the role of ABO in TMD. In addition, it highlights the impact of the US-Soviet Treaty on Intermediate-Range Nuclear Forces upon the US TMD Program.

45334 **(AD-A—192801/9/XAB) Implications of the INF (intermediate nuclear force) treaty on NATO strategy. Student report.** Amend, J.H. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Mar 1988. 31p. (ACSC—88-0100). NTIS, PC A03/MF A01.

The INF Treaty has refocused NATO attention on the long-standing concern of the applicability of the current NATO strategy. This study examines the implications of the INF Treaty on the current NATO strategy of Flexible Response. The tenets of Flexible Response include sustainability and escalation control. This study concludes that even prior to the INF Treaty, Flexible Response was not a valid strategy due to lack of sustainability and escalation control. In the absence of a valid Flexible Response Doctrine, NATO strategy reverts to massive Retaliation. Recommendations to alleviate this situation are suggested.

45335 **(AD-A—192912/4/XAB) What to do about ASAT. Progress report.** Pettit, E. (Army War Coll., Carlisle Barracks, PA (USA)). 29 Feb 1988. 46p. NTIS, PC A03/MF A01.

Although the Strategic Defense Initiative currently dominates the military space issue scene, the development of an anti-satellite (ASAT) program is another critical issue that must be reckoned with. This study addresses several of the outstanding questions, issues, and concerns about ASAT, including its rationality, military essentiality, impact on arms-control pursuits, and relationship with Ballistic Missile Defense (BMD) initiatives. The purpose is to highlight the diversity and significance of the issues and opinions, and demonstrate the need for immediate and serious discussion and resolution.

45336 **(PB—88-203260/XAB) Project Europe: conditions of conventional military power in central Europe. Summary report (Final).** Andren, K.; Johansson, L. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Feb 1988. 57p. (FOA-C—10305). NTIS, PC E04/MF A01.

In June 1984, the Supreme Commander was requested by the Government to carry out a study jointly with the National Defence Research Institute concerning military-strategic, military-operative, and military-technical conditions in Central Europe. The studies in Project Europe were carried out by a special project group at the defense staff. They had a wide scope with participation of experts from both ministries and total defense authorities. Areas of study included differences distinguishing military alliances, military forces in the alliances, options of the Warsaw Pact and NATO, issues associated with disarmament, and long-term trends.

3502 Proliferation

REFER ALSO TO CITATION(S) 45647

36 MATERIALS

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 44784, 44786, 45004, 45004, 45014, 45015, 45015, 45050, 45147, 45211, 45396, 45467, 45467, 45521, 45560, 45561, 45562, 45563, 46081, 46161, 46167

45337 **(AD-A—192335/8/XAB) Determination of Tafel constants in nonlinear polarization curves. Master's thesis.** O'Loughlin, T.E. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 140p. NTIS, PC A07/MF A01.

The presence of nonlinear behavior in potentiodynamic polarization plots has resulted in difficulty in determining the Tafel constants from such plots. A FORTRAN-based program involving numerical-differentiation techniques was used to determine the existence of the Tafel regions. Various alloys polarized in synthetic seawater and a 3.5% NaCl solution were analyzed. Although severe concentration polarization often dominated the cathodic branches, the techniques employed did allow for the selection of regions that approached linear behavior. The effects of concentration polarization in hindering the determination of Tafel constants were exemplified by the uncovering of a cathodic branch containing a small region where only activation polarization dominated, followed by the onset and total domination of concentration polarization. A method of determining where the anodic and cathodic currents begin to dominate the potentiodynamic polarization curve is introduced.

45338 **(AD-A—192411/7/XAB) Manufacturing of titanium alloy cannon components. Interim technical report, February-December 1986.** Wakulenko, A. (Army Armament Research and Development Command, Watervliet, NY (USA). Benet Weapons Lab.). Feb 1988. 27p. (ARCCB-TR—88009). NTIS, PC A03/MF A01.

This report contains the results of the first phase of a multi-year Manufacturing Methods and Technology project that addresses the manufacturing approach of new materials under consideration for cannon-tube components. Activities concentrated on the assemblage of preliminary machinability data for a Beta-C, 3A1-8V-6Cr-4Zr-Mo, titanium (Ti) alloy to support in-house machining requirements. In addition, machinability tests were performed by an independent laboratory to develop a substantial data base for optimizing the manufacture of Ti alloy production components.

45339 (AD-A—192711/0/XAB) Bulk plasmon-enhanced photoemission from Nb(100) surface resonances. Report for 1 April 1987-31 March 1988. Fang, B.S.; Ballentine, C.A.; Erskine, J.L. (Texas Univ., Austin (USA). Dept. of Physics). 8 Apr 1988. 17p. NTIS, PC A03/MF A01.

The electronic properties of Nb(100) are studied using angle-resolved photoemission. Several surface resonances are identified. One surface resonance exhibits significant enhancement of the photoemission cross section at the bulk plasma energy, suggesting a novel probe of surface resonances having high degree of second-layer charge density. The authors report the observation of bulk-plasmon-enhanced photoemission from Nb(100) surface resonances. This effect offers a sensitive direct probe of the spatial extent of surface states and surface resonances at metal surfaces in cases where a high degree of second-layer charge density exists in the two-dimensional Brillouin zone. A related enhancement effect was recently reported by Drube and Himpsel for inverse photoemission. Photoemission cross section resonances associated with surface states that arise from final state effects were also observed on silver and copper surfaces. However, these resonances are produced by a distinctly different mechanism than the one described in this paper.

45340 (AD-A—192921/5/XAB) Fundamental understanding of the interfacial compatibility in hybrid material systems. Annual technical report, 1 September 1986-31 October 1987. Tien, J.K. (Columbia Univ., New York (USA). Center for Strategic Materials). 7 Mar 1988. 20p. NTIS, PC A03/MF A01.

Among the problems associated with long-term high-temperature service of hybrid material systems is interdiffusional compatibility of the system's component materials. Efforts in this program have focussed on several area of this problem. One of the areas being examined are alkali-metal and alkaline-earth-metal diffusion barriers. These barriers are being applied by two different methods: ion implantation and a sol suspension slurry technique. For both methods, the system being utilized as a model is the tungsten/nickel system. Preliminary results of barrier effectiveness are given. Also being studied are the interdiffusional kinetics of metal/intermetallic and intermetallic/intermetallic ternary systems. Hybrids being examined include W/Ni_3AL and TiAl/Ni_3AL.

45341 (CEGB-TPRD/B—0954/R87) Reaction of uranium in the U-O/sub 2/-H/sub 2/O and U-H/sub 2/O systems. Pearce, R.J.; Kay, P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Sep 1987. 75p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753840/JAW.

The reaction of uranium in dry air, moist air and oxygen free moisture has been studied thermogravimetrically over the temperature range 105-325/sup 0/C and at water vapour pressures up to 100 kPa. It has been shown that in dry air the kinetics are complex and appear to result from parallel reactions involving both parabolic and linear rate laws. In oxygen free moisture, linear kinetics were obeyed and a near stoichiometric UO/sub 2/ reaction product was formed. Oxygen markedly inhibited the moisture reaction at the lower temperatures in the range examined but the degree of inhibition, as shown by weight gain measurements, decreased with increasing temperature such that, at the higher temperatures, there was little difference in reaction rates. At all temperatures, the production of hydrogen was markedly inhibited by the presence of air suggesting that the principal reaction was with free oxygen. However in moist conditions the reaction rate exhibited a dependency on the water vapour pressure according to $k \alpha psup(n)$ where $n \sim 0.3$ in air and ~ 0.5 in oxygen free conditions. The mechanism of the oxidation reaction is discussed.

45342 (CONF-880841—3) In-situ oxidation of Ni_3Al alloys. Lawless, K.R.; Cathcart, J.V.; Kenik, E.A. (Virginia Univ., Charlottesville (USA). Dept. of Materials Science; Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007177/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Ni_3Al is subject to dynamic embrittlement when tested in an oxidizing environment; whereas pre-oxidation under stress does not embrittle the alloy. In-situ HVEM oxidation studies of several ordered intermetallic ($L1_2$ structure) Ni_3Al alloys with small additions of boron and hafnium are reported. AEM studies of the oxidized specimens were also made to fully characterize the microstructure. Specimens were annealed and then electropolished to penetration just prior to insertion in the hot stage of the HVEM. Oxidations were carried out at an oxygen pressure of 13-60 mPa at 750{degree}C. Gas pressure and composition were monitored with a residual gas analyzer. Specimens raised to the operating temperature in the base vacuum showed no indication of oxide in the diffraction pattern and were almost entirely free of dislocations. 1 fig.

45343 (CONF-880841—8) Electron microscopy of modulated and ordered alloys. Bentley, J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 2p. (CONF-880841—). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88008667/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Modulated and ordered alloys are of interest not only from a basic standpoint but also because they often possess interesting properties or form the basis of commercial materials. Transmission electron microscopy (TEM) provides much unique and valuable information in the study of phase transformations in such alloys but, as this overview of the applicable methods will try to illustrate, the experimental work is often challenging and data interpretation is rarely straightforward. 26 refs.

45344 (CRIE-T—87007) Evaluation of high-temperature mechanical properties of 12Cr steels improved for ultra-super critical steam turbine rotors. Nitta, Akihito; Ogata, Takashi; Kuwabara, Kazuo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 35p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753860/JAW.

Development of heat resisting materials is indispensable for the development of ultra-super critical coal firing power plant which is now in progress. As regards materials for rotors which meet the requirements for the first step steam condition (316 kgf/cm^2 x 593°C), the development of the improved 12 Cr steel has become indispensable. Three rotor forgings of the improved 12 Cr steel were made on trial, and evaluated for practical use. The results of the executed evaluation test on various mechanical properties were summarized in this report, giving priority especially to properties of creep, creep repture, creep-fatigue crack, etc. which are indispensable for the evaluation of durability of rotors. The properties compared with the materials currently in use and the influence of long lasting overheating were studied. (25 figs, 5 tabs, 4 refs)

45345 (CRIE-T—87018) Water cooling technique of high temperature gas turbine blade. Numerial analysis of rotating circular pipe with core. Sakuma, Toshio; Arazeki, Hideo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 29p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753862/JAW.

A water-cooling system employing a circular pipe with core, an improvement on the Schmidt cooling system, was proposed, and the basic charactristics have been investigated. To study the heat tranfer in rotating annular pipes, an experiment was carried out using a pipe with core which is a simulated model of one of the cooling hole and rotates around the vertical axis. As the result, it became clear that the heat tranfer was influenced by secondary flow induced by Coliolis force. This paper describes the information obtained by the numerical analysis of the flow in the rotating annular pipes (secondary flow) required for the establishment of heat tranfer model in the rotating circular pipes with core. It also describes the effect of Coliolis force which influences the flow in the rotating annular pipes, as compared with the previously reported test result. In regard to the flow in the pipes, explanation was made about critical Reynold's approach run distance, friction coefficient of pipes, etc. The result of analysis of the simulated flow was studied and reported. (24 figs, 2 tabs, 20 refs)

45346 **(DOE/ER/45154—1) Mechanisms of transformation toughening.** Olson, G.B.; Parks, D.M. (Massachusetts Inst. of Tech., Cambridge (USA)). 1988. Contract FG02-84ER45154. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014233/JAW.

Mechanisms of transformation toughening in ductile solids are investigated by (a) detailed observations of crack-tip processes and (b) numerical modeling with experimentally-derived constitutive relations. Two series of model ally steels have been developed for convenient study of constitutive behavior. Constitutive relations based on strain-induced transformation kinetics are being refined for these homogeneous austenitic alloys and extended to dispersed-phase systems. Using alloy composition to vary phase stability, processes of shear-instability-controlled fracture at sectioned crack tips are observed with and without transformation plasticity interactions. Quantitative constitutive relations developed for the experimental alloys are applied to (a) crack-tip and notch fields to study transformation plasticity interaction with various models of microvoid-softening-induced shear localization, and (b) inclusion particle fields to examine direct interactions with microvoid nucleation. 21 refs., 10 figs., 1 tab.

45347 **(DOE/ER/45295—1) Atomistic studies of grain boundaries in alloys and compounds: Progress report, July 1987-June 1988.** Vitek, V. (Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science and Engineering). Feb 1988. Contract FG02-87ER45295. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011939/JAW.

In this research project we investigate the atomic structure and atomic level processes which occur at grain boundaries in binary alloys, both disordered and ordered. Atomistic, computer simulation studies of grain boundaries are carried out with the aim to elucidate the differences in structure, cohesion and, in general, physical and mechanical properties of boundaries in alloys when compared with those in pure materials. Until now most atomistic computer simulations utilized empirically constructed pair-potentials to describe interatomic forces. This is adequate when studying those structural aspects which are general, common to boundaries in various metals and alloys, and do not involve electronic, chemical and cohesive properties. An example is the investigation of those differences between boundaries in pure f.c.c. metals and $L1_2$ compounds that are related to the ordering tendency, which have been made as a part of this project. However, development of the studies of grain boundaries beyond purely structural considerations requires a more fundamental description of atomic interactions. For this reason we have concentrated at this stage upon the development of physically justified and adequate descriptions of atomic interactions. Two different approaches have been followed. First, empirical many-body potentials are being constructed for binary alloys and, secondly, a quantum mechanically based tight binding method for treating extended lattice defects such as grain boundaries is being developed. 10 refs.

45348 **(DOE/NE/37963—4) Deformation induced microstructural and microchemical changes during thermomechanical treatment: Annual progress report, October 1, 1986-September 30, 1987.** Bruemmer, S.M.; Atteridge, D.G.; Murr, L.E.; Wood, W.E. (Pacific Northwest Lab., Richland, WA (USA); Oregon Graduate Center, Beaverton (USA). Dept. of Materials Science and Engineering). 1987. Contract AC06-86NE37963. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88012984/JAW.

This research will develop a basic understanding and a methodology to predict the effects of a material's processing, fabrication and service history on its resistance to low-ductility failure. Basic and applied materials engineering components will be integrated to attain both mechanistic understanding and applications-oriented modeling during the program. Thermomechanical effects on the stress corrosion cracking of austenitic Fe-Cr-Ni and Ni-Cr-Fe alloys will be studied because of their critical importance in energy-production systems and the limitations in current understanding to model and predict microstructural and microchemical development. Program components will include detailed examination of temperature and strain effects on grain boundary structural defects, precipitate nucleation and growth, and redistribution of alloying and impurity elements. Practical applications of this data will be evolved through the characterization and simulation of thermomechanical histories developed during material processing, fabrication and service, and the direct correlation of grain boundary microstructure and microchemistry to SCC resistance. 30 figs., 5 tabs.

45349 **(DOE/NE/37963—5) Deformation induced microstructural and microchemical changes during thermomechanical treatment: Quarterly progress report, October-December 1987.** Bruemmer, S.M.; Atteridge, D.G.; Murr, L.E.; Wood, W.E. (Oregon Graduate Center, Beaverton (USA)). 1987. Contract AC06-86NE37963. 44p. NTIS, PC A04. Order Number DE88012987/JAW.

This report discusses the research activities in these areas during this report period. Reliability of construction materials is a key factor in the performance of all production facilities including electrical generation systems. Environmental degradation of piping, tubing rotors and cladding, as well as support and containment structures, has been a recurring failure mechanism in primary and secondary power plant components for many years. Susceptibility of components to environmental degradation is primarily controlled by the materials's grain boundary microstructure and microchemistry produced during processing, fabrication and service treatments. Two types austenitic "stainless" alloys are of particular importance in electric generation systems: (1) Fe-Cr-Ni alloys, such as Type 316 stainless steel, and (2) Ni-Cr-Fe alloys, such as Inconel Alloy 600. Both of these alloy types are widely used for critical power plant components and can become susceptible to intergranular corrosion and stress corrosion as a result of thermomechanical processing.

45350 **(DOE/NE/37963—6) Deformation induced microstructural and microchemical changes during thermomechanical treatment: Quarterly progress report, January-March 1988.** Bruemmer, S.M.; Atteridge, D.G.; Murr, L.E.; Wood, W.E. (Oregon Graduate Center, Beaverton (USA)). 1988. Contract AC06-86NE37963. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012988/JAW.

Reliability of construction materials is a key factor in the performance of all production facilities including electrical generation systems. Environmental degradation of piping, tubing rotors and cladding, as well as support and containment structures, has been a recurring failure mechanism in primary and secondary power plant components for many years. Susceptibility of components to environmental degradation is primarily controlled by the material's grain boundary microstructure and microchemistry produced during processing, fabrication and service treatments. Two types austenitic "stainless" alloys are of particular importance in electric generation systems: (1) Fe-Cr-Ni alloys, such as Type 316 stainless steel, and (2) Ni-Cr-Fe alloys, such as Inconel Alloy 600. Both of these alloy types are widely used for critical power plant components and can become susceptible to intergranular corrosion and stress corrosion as a result of thermomechanical processing. This report discusses research activities in these areas during this report period.

45351 **(INIS-BR—1107) On site X-ray control of heavy walled welds.** Babylas, E. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1986. 17p. (CONF-8609282—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703208/JAW.

From 1. non destructive testing congress for Latin America and Caribbean; Sao Paulo, Brazil (21 Sep 1986).

Our concern is to define what radiation source is economically interesting for thicknesees ranging from 45 to 65 mm, in accordance with quality standard imposed by specifications. Our first approach consisted in choosing between X-ray radiation and gamma radiation. In the range of thicknesses studied, the choice between an Iridium 192 source and an X-ray generator had to be considered.

45352 **(INIS-BR—1139) Tubes of stainless steel - Welding of fuel elements for nuclear industry.** Bittencourt, M.S.Q.; Carvalho Perdigao, S. de. (Associacao Brasileira de Soldagem, Sao Paulo). 1984. 16p. (In Portuguese). (CONF-8410493—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703239/JAW.

From 10. national meeting on welding technology; Vitoria, Brazil (21 Oct 1984).

Aiming at welding fuel elements of 316 AISI alloy steel by the TIG self generating process, the welding parameters which could provide. The major total penetration / width of welded fillet relation, were selected. Tensile tests at room temperature and at 650/sup 0/C were done in the obtained welds. (M.C.K.).

45353 **(INIS-BR—1156, pp 9) Chemical-bond approach to the dielectric constant of Se and Te.** Brum, J.A.; Ramos, J.G.P. 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

45354 **(INIS-BR—1156, pp 10) Electronic properties of inversion layers on narrow-gap semiconductors.** Marques, G.E.; Sham, L.J. (Sao Carlos Univ. (Brazil). Dept. de Fisica; California Univ., San Diego, La Jolla (USA). Dept. of Physics). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

45355 **(INIS-BR—1156, pp 24) Determination of the 3-dimensional lattice mismatch m-bar III - V liquid phase epitaxial layers.** Chang, S.-L. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

45356 **(INIS-BR—1156, pp 25) Studies of absorbed H/sup 2/ on the surface of W (Poly) with programed thermal desorption, stimulated electron desorption and variations of work function techniques.** Gonzalez, F.; Caballero, J.; Segovia, J.L. de; Sanchez, M. (Chile Univ., Santiago). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

45357 **(INIS-BR—1156, pp 41) Theory of the new Raman peak in 2H-NbSe/sub 2/ in the coexistent state of the charge density wave and superconductivity.** Kurihara, Y. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

45358 **(Juel—2152) Magnetic ordering and crystal field effects in cerium deuteride.** Abeln, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Koeln Univ. (Germany, F.R.)). Aug 1987. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754342/JAW.

In this work investigations of the magnetic order, crystal field effects and structural transformations in Ce deuteride by measurements of the magnetization and susceptibility, specific heat, neutron scattering, DTA and X-ray diffraction are presented. From this, it follows that both the exchange interaction and the crystal field ground state are strongly affected when the D atoms in the fcc lattice not only occupy the tetrahedral (T) sites but additionally the octahedral (O) sites. Similar to the ground state, also the magnetic order is strongly affected by the octahedral D atoms. From the complicated magnetic phase diagram obtained, it is assumed that the octahedral D atoms involve a ferromagnetic exchange interaction via the conduction electrons. This is confirmed by the observation that for D/Ce > 2.75, where the conduction electrons are frozen out, an antiferromagnetic structure appears which is nearly the same as in the metallic CeD/sub 1.95/ where the O sites are empty. (orig./BHO).

45359 **(LA-UR—88-1820) Amorphous powders of Al-Hf prepared by mechanical alloying.** Schwarz, R.B.; Hannigan, J.W.; Sheinberg, H.; Tiainen, T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880667—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014459/JAW.

From International powder metallurgy conference and exhibition; Orlando, FL, USA (5 Jun 1988).

We synthesized amorphous $Al_{50}Hf_{50}$ alloy powder by mechanically alloying an equimolar mixture of crystalline powders of Al and Hf using hexane as a dispersant. We characterized the powder as a function of mechanical-alloying time by scanning electron microscopy, x-ray diffraction, and differential scanning calorimetry. Amorphous $Al_{50}Hf_{50}$ powder heated at 10 K s/sup {minus}1/ crystallizes polymorphously at 1003 K into orthorhombic AlHf (CrB-type structure). During mechanical alloying, some hexane decomposes and hydrogen and carbon are incorporated into the amorphous alloy powder. The hydrogen can be removed by annealing the powder by hot pressing at a temperature approximately 30 K below the crystallization temperature. The amorphous compacts have a diamond pyramidal hardness of 1025 DPH. 24 refs., 7 figs., 1 tab.

45360 **(PB—88-201777/XAB) Film formation by an ICB deposition technique.** Ina, T.; Hanai, M.; Yamanishi, K.; Ito, H.; Kobayashi, M. (Mitsubishi Electric Corp., Tokyo (Japan)). 1987. 5p. NTIS, PC E04/MF A01.

Text in Japanese; Included in Mitsubishi Denki Giho, Vol. 61, No. 12, 54-57(1987).

An ionized cluster-beam (ICB) deposition technique was used to form layers of metals, oxides, and nitrides, and the effects of the ion energy were examined. Samples showed excellent reflective index, adhesive strength, and crystalline structure. When reactive ionized cluster-beam deposition was used to form the oxide and nitride films, the ion beam improved the chemical reactions and changed the stoichiometry. In addition, it was found that crystalicity and its orientation could be controlled by the ion-acceleration voltage. The article reports on the ICB deposition technique, and the results of forming various kinds of films.

45361 **(SKB-TR—87-02) Fuel rod D07/B15 from Ringhals 2 PWR: Source material for corrosion/leach tests in groundwater. Fuel rod/pellet characterization program. Pt. 1.** Forsyth, R. (ed.). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). Mar 1987. 107p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754365/JAW.

A joint SKB/STUDSVIK experimental program to determine the corrosion rates and to establish the corrosion mechanisms of spent UO/sub 2/ fuel in groundwater under both oxidizing and reducing conditions is in progress in the Hot Cell Laboratory of Studsvik Energiteknik AB. High burnup fuel of both BWR and PWR type are studied. Characterization of the spent fuel at both rod and pellet level is an important part of the experimental program. Experiments on PWR fuel have been concentrated so far on specimens from one rod, manufacturer's number 03688, which had occupied position B15 in assembly D07. This assembly had been irradiated for 5 cycles in the Ringhals 2 reactor between 1977 and 1983. The calculated assembly burnup was 41.3 MWd/kg U. The present report is a collection of separate reports describing those items in the characterization program which have been performed so far. No overall summary of the experimental results is given here, and the report should be viewed as a collection of reference data.

45362 (SKB-TR—87-16) Corrosion tests on spent PWR fuel in aysnthetic groundwater. Forsyth, R.S.; Werme, L.O. (Studsvik Energiteknik AB, Nykoeping (Sweden)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). Sep 1987. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754367/JAW.

Short fuel/clad segments from a high burnup PWR fuel rod have been exposed to simulated groundwater under both oxidizing and reducing conditions. Two methods of establishing reducing conditions were employed: by using H/sub 2/ gas in the presence of Pd catalyst, and by circulating the groundwater over rock-cores from a deep bore-hole. The results from the first two contact periods of 82 and 172 days are in good agreement with those obtained previously on a high burnup BWR fuel rod. In particular, it was found that under oxidizing conditions, uranium saturates at about the 1 mg/l level, and plutonium at about the 1 μg/l level. Under reducing conditions, these solubilities decreased by about two orders of magnitude.

45363 (UCRL—97328) Developments and trends in electrodeposition. Dini, J.W. (Lawrence Livermore National Lab., CA (USA)). 30 Mar 1988. Contract W-7405-ENG-48. 10p. (CONF-880855—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009822/JAW.

From 2. international SAMPE metals and metals processing conference; Dayton, OH, USA (2 Aug 1988).

Electrodeposition is a very important technology. Covering inexpensive and widely available base materials with a thin (typically 0.1 to 10 μm) coating with specific properties extends their use to applications which otherwise would have been prohibitively expensive. Furthermore, the ability to provide property control in coatings as thick as 10 mm adds further value to this important technique of surface modification. In recent years a number of advances in areas such as composite plating, pulse plating and high speed plating have added further credence to the use of electrodeposition as a viable coating technology. This paper will review these branches of the industry and discuss future trends. 29 refs., 1 fig., 4 tabs.

45364 A model for tungsten nucleation on oxide. McConica, C.M. (Dept. of Chemical Engineering, Colorado State Univ., Fort Collins, CO (US)). pp 51-58 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

The rate of initiation of tungsten nuclei on thermal oxide has been determined as a function of time, temperature and distance from areas of tungsten growth. The creation rate of infinitely small nuclei increases exponentially with time and decays exponentially with distance form large regions of tungsten growth. As time passes, the nucleation front progresses away from regions of tungsten deposition. The results suggest an autocatalytic nucleation phenomenon coupled with either gas phase or surface diffusion of the reactive intermediate. An activation energy for nucleation of 25 kcal mol/sup -1/ was determined using three independent methods. It is hypothesized that HF attacks the SiO/sub 2/ to form SiF/sub x/ in the presence of tungsten catalyst. Solution of the reactor continuity equation shows that the steady state HF pressure is most sensitive to reactive area (hot metallic surfaces) in the reactor.

45365 Observations on selectivity loss during tungsten CVD. Creighton, J.R. (Sandia National Labs., Div. 1126, P.O. Box 5800, Albuquerque, NM (US)). pp 43-50 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

Possible mechanisms for the loss of selectivity during tungsten CVD (i.e., growth on SiO/sub 2/) were investigated using a dual vacuum system composed of a growth chamber and a UHV analysis chamber equipped with Auger and mass spectroscopy. An oxide-covered silicon sample could be transferred between the two chambers while under vacuum to maintain surface composition integrity. With this experimental system, the authors have found evidence for a selectivity loss mechanism which involves desorption of tungsten subfluorides from tungsten surfaces. The disproportionation of the subfluorides then produces a reactive state of tungsten on the SiO/sub 2/ surfaces that leads directly to selectivity loss.

45366 Status of plutonium purification by bismuth solvent anode electrorefining. Fife, K.W.; Bowersox, D.F.; McCurry, L.E.; Lopez, P.C.; Brown, C. (Los Alamos National Lab., Los Alamos, NM (US)). pp 888-895 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Recent investigations into plutonium purification by electrorefining from a molten secondary-metal solvent anode pool (metal solvent: Pu ≧ 1) have concentrated on bismuth and bismuth . gallium solvents contained in shallow tantalum crucibles. Electrorefining is reversed from our standard LAMEX cell design and occurs via plutonium oxidation from a high-surface-area anode, using either molten NaCl . KCl or LiCl . KCl electrolytes and reduction on a cylindrical tungsten cathode. The are recovering high-purity plutonium from electrorefining anode residue and from PuO/sub 2/ reduction product. Recently, the authors have been recycling the spent solvent and are achieving overall plutonium recoveries similar to those obtained from electrorefining.

45367 Kinetic model for ductile-brittle fracture mode transition behavior. Kameda, J. (Ames Lab., Iowa State Univ., Ames, IA (US)). *Acta Metallurgica;* **34**: No. 12, 2391-2398(Dec 1986).

A kinetic model for ductile-brittle fracture mode transition has been developed. In the ductile-brittle transition temperature range, brittle and ductile fracture are characterized in terms of thermally activated growth processes of tensile model I and shear model II cracks, respectively. The thermally activated bond breaking in tension and shear are assumed to proceed under the conditions of local stress relaxation due to dislocation nucleation at the crack tip. The dislocation nucleation rate is considered to be proportional to the strain rate. The tensile and shear fracture probabilities are defined by the product of the jump probability from the stretching to the breaking state of bonds at the crack tip, the active volume, and the density of microcracks or microvoids. The ductile-brittle transition temperature can be determined provided both the tensile and shear fracture probabilities are the same. The ductile-brittle transition temperature is given as a function of the activation energies for bond breaking in tension and shear and dislocation nucleation as well as the microstructural and mechanical parameters. This kinetic model provides a rationale for an experimentally determined linear relationship of the ductile-brittle transition temperature measured by small punch test to that by Charpy V notch tests on temper embrittled steels.

45368 Study of energy vs misorientation for grain boundaries in gold by crystallite rotation method-II. Tilt boundaries and mixed boundaries. Chan, S.W.; Balluffi, R.W. (Dept. of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA (US)). *Acta Metallurgica;* **34**: No. 11, 2191-2200(Nov 1986).

In Part I small gold crystallites were welded to thin film single crystal gold substrates at different controlled misorientations to produce pure twist boundaries in the neck regions which could be observed directly by transmission electron microscopy. In this work these experiments are extended to include pure tilt and also mixed (tilt/twist) boundaries.

45369 Statistical analysis of cleavage fracture ahead of sharp cracks and rounded notches. Lin, T.; Evans, A.G.; Ritchie, R.O. (Materials and Molecular Research Div., Lawrence Berkeley Lab. and Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA (US)). *Acta Metallurgica;* **34**: No. 11, 2205-2216(Nov 1986).

Mechanisms of initiation and unstable propagation of transgranular cleavage cracks are compared for brittle fracture ahead of sharp cracks and rounded notches, e.g. for fatigue pre-cracks and Charpy V-notches, respectively, in standard toughness specimens. The comparison is made over a range of temperatures, from the lower shelf into the ductile/brittle transition region, for a single phase materials containing a known distribution of particles where weakest link statistics can be used to model the onset of catastrophic failure. Using linear and nonlinear elastic solutions for the stress distribution ahead of a sharp crack, and slip-line field solutions, modified for a power hardening material, for the rounded notch, statistical modelling is employed to define the critical dimensions ahead of the crack or notch tip where initial cracking events are most probable. The analysis provides an interpretation of the role of stress gradient in governing microscopic fracture behavior. Predictions are evaluated by comparison with experimental results on the low temperature flow, Charpy V-notch and plane strain fracture toughness behavior of a low carbon mild steel with simple ferrite/grain boundary carbide microstructures.

45370 **Diffusivity of hydrogen in Pd-Ag-H ternary solid solutions.** Ishikawa, T.; McLellan, R.B. (Dept. of Mechanical Engineering and Materials Science, Rice Univ., Houston, TX (US)). *Acta Metallurgica;* **34**: No. 9, 1825-1832(Sep 1986).

An electrolytic double-cell system has been used to determine the variation of diffusivity through Pd-Ag membranes as a function of temperature in the range 280-333K and Ag composition in the range 0-30 at.%. The experimental diffusivities have been analyzed in terms of the cell theory of interstitial solid solutions. At a given temperature the diffusivity shows an initial small increase with increasing Ag concentrations. This is due to lattice dilation effects. As the Ag concentration increases beyond 0.05 at.%, diffusivity decreased due to the generation of trapping sites for H atoms.

45371 **Equilibrium and growth characteristics of hydrogen-induced intergranular cracking in phosphorus-doped and high purity steels.** Kameda, J. (Ames Lab., Iowa State Univ., Ames, IA (US)). *Acta Metallurgica;* **34**: No. 9, 1721-1736(Sep 1986).

By means of fracture mechanics analyses, acoustic emission techniques, and fracture surface analyses by scanning Auger microscopy and X-rays, it was determined how segregated phosphorus, yield strength and grain size affect equilibrium and growth characteristics of hydrogen-induced intergranular cracking in high strength steels. The effect of yield strength on the threshold stress intensity was found to be greater than those of phosphorus segregation and grain size. The intergranular phosphorus segregation greatly accelerated the growth rate of hydrogen-induced intergranular cracking and caused a large number of acoustic signals to be emitted during the crack growth. The crack growth rate increased in a steel with segregated phosphorus and slightly decreased in high purity steels, where only occasional acoustic emissions were measured during the cracking process, by increasing grain size. Fracture surface analyses indicated more featureless intergranular fracture facets and higher levels of residual strain in the lattice adjacent to the fracture surface in the phosphorus-doped steel than in the high purity steels. These results suggest that while in steels with segregated impurities, the macrocrack tends to grow by rapid formation of intergranular microcracking which gives rise to dislocation emissions at the growing crack tip. In high purity steels, slow growth of intergranular microcracking proceeds which is accompanied by either the absence or mitigation of dislocation generation at the crack tip.

45372 **The effect of diffusive hydrogen segregation on fracture of polycrystalline nickel.** Lassila, D.H.; Birnbaum, H.K. (NASA-Ames Research Center, Moffett Field, CA (US)). *Acta Metallurgica;* **34**: No. 7, 1237-1244(Jul 1986).

Hydrogen embrittlement was studied under conditions which allowed diffusion and segregation of hydrogen to grain boundaries to be controlled. Even at high solute concentrations of hydrogen, the fracture mode was ductile shear rupture if transport of hydrogen to grain boundaries was not allowed. As the amount of hydrogen segregation increased, the fracture mode became intergranular. Analysis of temperature dependence yields a hydrogen segregation enthalpy of 11.6KJ/mol. The transition was also observed at a constant aging temperature by increasing the solute hydrogen concentration. The kinetics suggest that the hydrogen segregation layer extends about 35 nm from the grain boundary. The fracture mechanism is a softening in region due to the high hydrogen concentration.

45373 **The fine structure F.C.C./B.C.C. boundaries in a Cu-0.3% Cr alloy.** Hall, M.G.; Aaronson, H.I. (Centre for Materials Science, Univ. of Birmingham, Birmingham B15 2TT (GB)). *Acta Metallurgica;* **34**: No. 7, 1409-1418(Jul 1986).

The interfacial structures of overaged b.c.c. precipitates was studied with transmission electron microscopy and the results are compared with theoretical structures obtained with the O-lattice calculation. The precipitates have a range of orientation relationships. All precipitates showed at least one fine dislocation array and several arrays with two sets of dislocations were also observed. For three precipitates investigated in detail, reasonably good agreement between the theoretical and observed values of the spacings, directions of dislocations and overall habit planes of the interfaces was obtained.

45374 **Grain boundary accommodation of slip in Ni/sub 3/Al containing boron.** Schulson, E.M.; Weihs, T.P.; Baker, I.; Frost, H.J.; Horton, J.A. (Thayer School of Engineering, Dartmouth College, Hanover, NH (US)). *Acta Metallurgica;* **34**: No. 7, 1395-1400(Jul 1986).

Experiments at room temperature have established that the addition of 750 ppm by weight (0.35 at.%) of boron to stoichiometric Ni/sub 3/Al reduces the effectiveness with which grain boundaries strengthen the alloy. This effect leads to boron-induced weakening of the most finely grained aggregates ($d \leqq 10$ μm). The effect of boron is explained in terms of an increase in the mobility of grain boundary dislocations and is related to boron-induced ductility.

45375 **Surface segregation of deuterium in a Nb-V alloy.** Ladna, B.; Loxton, C.M.; Birnbaum, H.K. (Materials Research Lab. and Dept. of Metallurgy and Mining Engineering, Univ. of Illinois at Urbana-Champaign, Urbana, IL (US)). *Acta Metallurgica;* **34**: No. 5, 899-904(May 1986).

Segregation has been studied using Secondary Ion Mass Spectroscopy (SIMS). A number of effects were observed which affected the ion yield of deuterium from the surface. Chief among these are diffusion of deuterium to the surface during sputtering, segregation to regions of high solute oxygen concentrations, trapping at ion damaged regions produced by sputtering and segregation to surfaces. Surface segregation extends over distances on the order of 50 nm and have a maximum concentration enhancement of about 100.

45376 **Creep cavitation and grain boundary structure in type 304 stainless steel.** Don, J.; Majumdar, S. (Dept. of Mechanical Engineering, Southern Illinois Univ., Carbondale, IL (US)). *Acta Metallurgica;* **34**: No. 5, 961(May 1986).

Grain boundary cavitation in Type 304 stainless steel under creep loading was investigated. Scanning electron microscopy observations showed that cavitation varied among different grain boundaries even when similarly oriented to stress direction. Changes in cavitation were also observed across twin boundaries intersecting a grain boundary facet. The correlation between cavity density and boundary structure was characterized by high voltage electron microscopy and Kikuchi patterns. The results are analyzed in the light of modern grain boundary models. In general, cavities were found on most random high-angle boundaries, whereas coincident site lattice (CSL) boundaries tended to resist cavitation. Of the total boundaries (excluding twins), 53% were CSL boundaries; this percentage greatly exceeds available theoretical predictions based on random grain orientation.

45377 **Relationships between grain boundary structure and energy.** Wang, G.J.; Vitek, V. (The Central Iron and Steel Research Institute, Beijing (CN)). *Acta Metallurgica;* **34**: No. 5, 951-960(May 1986).

The Read-Shockley equation describing the dependence of grain boundary energy on misorientation of grains has been reformulated using the recently developed structural unit model of the atomic structure of grain boundaries so that it is applicable to general high angle boundaries. The boundary energy then consists of the energy of a reference structure, and of the core and elastic energies of the corresponding DSC dislocations. While the latter part of the boundary energy is determined using the elastic theory of dislocations the former two parts are determined on the basis of atomistics of grain boundaries employing the structural unit model. In the framework of this analysis the minimum number of reference structures in a give misorientation range as well as the extent of misorientations related to a given reference structure are determined. The positions of cusps in the energy vs misorientation dependence and their relative depths and extent are also determined. The validity of this model is demonstrated for tilt boundaries studied by atomistic computer simulations.

45378 **A microscopic model of hydrogen-induced intergranular cracking-II. Steady state crack growth.** Kameda, J. (Ames Lab., Iowa State Univ., Ames, IA (US)). *Acta Metallurgica;* **34**: No. 5, 883-890(May 1986).

A steady state model of hydrogen-induced intergranular crack growth has been developed. It is assumed that the steady state growth of an intergranular crack, screened by dislocations, is controlled by the grain boundary and crack surface diffusion processes of hydrogen. A series of second-order differential equations controlling the diffusion processes of hydrogen in the intergranular crack regions is solved numerically to determine the hydrogen distribution along a steadily moving crack and thereby the change of the ideal work of fracture. The relationship of the stress intensity required for crack growth to crack velocity is established as a function of grain boundary and crack surface diffusivities, crack length, and grain size. While susceptibility to hydrogen-induced intergranular crack growth increases with increasing hydrogen diffusivities, it decreases with increasing crack length and grain size. The effect of grain size on growth of hydrogen-induced intergranular cracking are discussed in terms of the direction change of the hydrogen flux along the moving crack.

45379 **A microscopic model of hydrogen-induced intergranular cracking-I. Equilibrium crack growth.** Kameda, J. (Ames Lab., Iowa State Univ., Ames, IA (US)). *Acta Metallurgica;* **34**: No. 5, 867-882(May 1986).

A microscopic model of hydrogen-induced intergranular cracking is developed using the premise that a crack tip maintains a local equilibrium condition. It is assumed that the local equilibrium condition at the crack tip is achieved by the presence of screening dislocations. The embrittlement mechanism is a reduction of surface and grain boundary energies due to segregation of hydrogen. Equilibrium segregation of hydrogen in the intergranular crack region is examined and the change of the ideal work of slow and fast intergranular fracture is determined using a thermodynamic theory. Using a dislocation-screened crack model, it is difficult for fast intergranular fracture to be induced by hydrogen but at low levels of applied stress intensity segregation to crack surfaces readily facilitates slow crack growth along grain boundaries. The mechanisms are discussed in comparison with the model of a plastically deformed crack.

45380 **The effect of stress state on the hydrogen embrittlement of nickel.** Kampe, S.L.; Koss, D.A. (Dept. of Metallurgical Engineering, Michigan Technological Univ., Houghton, MI (US)). *Acta Metallurgica;* **34**: No. 1, 55-62(Jan 1986).

The ductility of nickel sheet subjected to in situ cathodic hydrogen charging has been investigated over a range of multiaxial stress states including uniaxial, plane-strain, and equibiaxial tension. The extent of ductility loss due to hydrogen increases as the stress state tends from uniaxial to equibiaxial tension. Hydrogen embrittlement is characterized by intergranular fracture with failure due to microcrack formation, microcrack link-up, and macrocrack growth. The increased susceptibility to intergranular embrittlement with increasing biaxiality is a consequence of an enhanced rate of the link-up of strain-induced intergranular microcracks.

45381 **Thermodynamic studies of oxygen behavior in tantalum-based alloys.** Lee, J.S.; Altstetter, C.J. (Dept. of Metallurgy and the Materials Research Lab., Univ. of Illinois at Urbana-Champaign, Urbana, IL (US)). *Acta Metallurgica;* **34**: No. 1, 139-146(Jan 1986).

A study of equilibrium thermodynamic properties of oxygen in pure tantalum and tantalum alloyed with V, Nb or Mo was made by EMF measurements on solid electrolytic cells over the temperature range 873-1373 K (600-1100°C). The solubility of oxygen in pure tantalum in equilibrium with Ta/sub 2/O/sub 5/ was determined to be C/sub s/ = 12.4 exp[-(16kJ/mol)/(RT)] over the experimental temperature range. It was concluded that oxygen obeys Henry's law for concentrations up to the terminal solubility in tantalum for the temperature range 873-1373 K (600-1100°C). The oxygen activity coefficient increased with Mo content in Ta-Mo alloys and decreased with V content in Ta-V alloys. The results showed no change in thermodynamic behavior by adding Nb to Ta-O alloys. The positive deviation of the oxygen activity coefficient in Ta-Mo alloys is evidence of a repulsive interaction between molybdenum and oxygen atoms.

45382 **Decomposition behavior of a nickel-silicon alloy.** Dvorack, M.A.; Epperson, J.E.; Chen, H. (Dept. of Metallurgy and Mining Engineering and Materials Research Lab., Univ. of Illinois at Urbana-Champaign, Urbana, IL (US)). *Acta Metallurgica;* **34**: No. 1, 117-124(Jan 1986).

The decomposition of a Ni-12.5 at.% Si alloy single crystal was investigated by a high temperature in situ x-ray diffraction study which entailed a Gorskii-Bragg-Williams thermoydnamic model which provides a means of predicting decomposition mechanisms within the two-phase equilibrium region of a binary alloy having an fcc disordered matrix plus ordered domains with an Ll/sub 2/ (Cu/sub 3/Au type) superstructure. In order to determine if a unique ordering "instability" temperature can be associated with the development of the γ (Ni/sub 3/Si) phase, various heating rates were used while monitoring growth of the 100 superlattice reflection of an initially disordered specimen. This study showed that the onset of the γ phase growth depends on the heating rate suggesting that nucleation and growth processes govern decomposition behavior. This result is supported by cyclic heating studies in which growth of the γ phase depends on thermal history as predicted by diffusion-controlled growth.

45383 **Measuring weld pool geometry from pool dynamics.** Hardt, D.E. (Lab. for Manufacturing and Productivity, Massachusetts Institute of Technology, MA (US)). pp 3-18 of Modeling and control of casting and welding processes. Kou, S.; Mehrabian, R. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860132—).

From Modeling and control of casting and welding processes conference; Santa Barbara, CA, USA (12 Jan 1986).

One of the critical variable to be controlled during arc welding is the size or geometry of the weld pool. The measurement of pool geometry has become an increasingly important problem with the advance of welding automation and control, and this paper addresses that problem. The basic concept of pool size estimation via measurement of pool dynamics is presented. The theory underlying this concept is discussed and is followed by a review of the current work in this area. It is concluded that pool dynamics can be characterized by natural frequencies of oscillation, for stationary welds, and that these can be measured by appropriate signal processing performed on the arc voltage. However, it appears that only full penetration welds show a strong correlation between weld size and natural frequency. Also, the extension of these results to the realistic case of moving welds has yet to be considered in detail. Nonetheless, this method of in-process measurement for real-time weld process control is still quite attractive where applicable since it can be accomplished simply by modifying the arc current schedule and by signal processing of the arc voltage.

45384 **Electrode tip melting simulation during vacuum arc remelting of Inconel 718.** (Sandia National Labs., Albuquerque, NM (US)). pp 95-106 of Modeling and control of casting and welding processes. Kou, S.; Mehrabian, R. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860132—).

From Modeling and control of casting and welding processes conference; Santa Barbara, CA, USA (12 Jan 1986).

The goal of this paper is to present a tool to simulate transient melting of the electrode tip. This capability is needed to develop and test furnace control algorithms since experimental determination is difficult and expensive. Simulation incorporates parameters (including arc voltage, arc current, electrode gap and furnace pressure) from previous quasisteady experiments with 460 mm diameter Inconel 718 electrodes. Cathode heating rates (determined by classical as well as experimental arc models) are linked to these independent variables. After radiative loss adjustments to the heating, transient one dimensional melting is computed.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 45166, 45168, 45360, 45363, 45411, 45503, 46133, 46134

45385 **(AD-A—192243/4/XAB) Effects of thin compressive films on indentation fracture toughness measurements.** Kobrin, P.H.; Harker, A.B. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). 1988. 17p. NTIS, PC A03/MF A01.

Thin compressive films have been shown to decrease the lengths of radial cracks produced by a Vickers indentation in a variety of nonmetallic materials. The intrinsic stress of submicron thick films deposited by reactive ion-beam sputtering was measured by a cantilever technique. The change in the apparent identation fracture toughness of the coated material was correlated with film thickness and stress, identation load, and the nature of the substrate.

45386 **(AD-A—192293/9/XAB) Calculation of multicomponent refractory-composite phase diagrams. Final report, 1 January-1 June 1986.** Kaufman, L. (Manlabs, Inc., Cambridge, MA (USA)). 1 Jun 1986. 52p. NTIS, PC A04/MF A01.

Candidate materials being studied can be used at temperatures as high as 5000 °F. In order to attain this goal, a series of refractory compounds are being considered that can be used as composites. These composites are based on combinations between carbon (C), zirconium (Zr), boron (B), and silicon (Si) or C, hafnium (Hf), B and Si. In order to investigate where melting can be expected in the candidate composite systems, coupled phase diagram/thermochemical descriptions of the Hf-B, Hf-C, Zr-B and Zr-C binary systems were developed and combined with previously derived descriptions of the B-C, Zr-Si-C binary systems in order to calculate the temperatures at which melting occurs in the composition ranges between C-ZrC-ZrB_2-B_4C, C-HfC-HfB_2-B_4C, HfC-SiC, ZrB_2-SiC and HfB_2-SiC.

45387 **(AD-A—192394/5/XAB) Near-ultraviolet - visible - near-infrared optical behavior of sputter-deposited GeO(x) (1.85 → x → 2.30).** Aita, C.R.; Marhic, M.E.; Sayers, C.N. (Wisconsin Univ., Milwaukee (USA)). Jun 1987. 7p. NTIS, PC A02/MF A01.

This paper describes the reactive sputter deposition and optical characterization of GeOx where x lies between 1.85 and 2.30. The films were grown by sputtering a Ge target in O_2-bearing atmospheres containing 0 to 80% Ar. Films deposited in 0 to 60% Ar were nominally germania. However, transmission in the UV-visible, the strength of the 245nm defect center, the optical absorption coefficient, and the optical energy band gap were strongly influenced by the presence of Ar in the discharge. Films deposited in gas containing 80% Ar were substoichiometric germania.

45388 **(AD-A—192629/4/XAB) Reversible laser chemically induced phase transformations in thin-film Ba_2YCu_3Ox superconductors.** Rothchild, M.; Sedlacek, J.H.; Black, J.G.; Ehrlich, D.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1 Feb 1988. 4p. (JA—6065). NTIS, PC A02/MF A01.

Pub. in Applied Physics Letters, Vol. 5, No. 1, 404-406(1 Feb 1988).

Phase transformations of a thin film of Ba_2YCu_3Ox were induced with a focused laser beam in chemical ambients. The transformation, involving superconductive and nonsuperconductive phases, are achieved rapidly and with a high degree of spatial control. They are fully reversible, and the appropriate processing parameters were studied. These effects are interpreted within present models, which relate the superconducting properties of Ba_2YCu_3Ox to its oxygen content and crystalline structure.

45389 **(AD-A—192630/2/XAB) Laser patterning of metal-oxide superconductor films by reactive solid-state transformation.** Rothchild, M.; Sedlacek, J.H.; Black, J.G.; Ehrlich, D.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Feb 1988. 5p. (JA—6057). NTIS, PC A02/MF A01.

Pub. in IEEE Electron Device Letters, Vol. 9, No. 2, 68-70(Feb 1988).

A planar submicrometer-resolution patterning method was developed for fabrication of thin-film Ba_2YCu_3Ox devices without photoresist, water, or solvent exposure. The method is based on a rapid transformation from the superconductive to a dielectric phase. The phase change is induced by controlled changes in the oxygen stoichiometry which are induced thermally by local-area laser irradiation of the thin film in a gaseous ambient. Both extended-area pattern projection and scanned-beam direct writing were demonstrated with a spatial resolution in the submicrometer range and presently limited by the grain size of available films. Negligible thickness loss is observed in patterning. The method circumvents lithographic techniques that tend to degrade the electronic quality of Ba_2YCu_3Ox superconductors.

45390 **(AD-A—192946/2/XAB) Wave and fracture phenomena in impacted ceramics. Periodic report No. 1, December 1987-February 1988.** Winkler, S. (Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany, F.R.)). Feb 1988. 4p. (U—5/88). NTIS, PC A02/MF A01.

An optical measuring technique in combination with high-speed photography is provided to solve the problem of this contract, the investigation of wave and fracture phenomena in opaque ceramic materials. Surface disturbances caused by these mechanical events will deflect reflected light from its ordinary direction and thus give rise for shadow patterns that can be photographed. Specimens with the dimensions 100 by 10mm shall be impacted on one of the smaller surfaces by a projectile in order to generate these events. In parallel to this work, it is planned to prepare specimens of alumina, for it is believed that with this material, results can be obtained easier than with boron carbide.

45391 **(INIS-BR—1116) Mechanical properties of β-sialon containing Y/sub 2/O/sub 3/.** Bressiani, J.C.; Greil, P.; Petzow, G. (Associacao Brasileira de Ceramica, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8604394—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703217/JAW.

From 30. Brazilian congress on ceramic; Rio de Janeiro, Brazil (1 Apr 1986).

45392 **(INIS-BR—1117) Oxidation of Si/sub 3/N/sub 4/ ceramics.** Bressiani, J.C.; Greil, P.; Petzow, G. (Associacao Brasileira de Ceramica, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8604394—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703218/JAW.

From 30. Brazilian congress on ceramic; Rio de Janeiro, Brazil (1 Apr 1986).

45393 **Temperature dependence of the positron annihilation lifetime in single-crystal $YBa_2Cu_3O_7$.** Harshman, D.R.; Schneemeyer, L.F.; Waszczak, J.V.; Jean, Y.C.; Fluss, M.J.; Howell, R.H.; Wachs, A.L. (AT & T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review [Section] B: Condensed Matter;* **38**: No. 1, 848-851(1 Jul 1988).

We report our measurements of the temperature dependence of the positron lifetime spectrum in single-crystal $YBa_2Cu_3O_7$. Contrary to earlier measurements in sintered powders, we observe only a single lifetime component tau for temperatures in the range 5 K<T<297 K, exhibiting a constant value (tau≈176 ps) above T/sub c/ and increasing monotonically below T/sub c/ to ≈187 ps at 5 K. Possible correlations with the superconducting gap, relaxation of the oxygen atoms, or a redistribution of the electrons are discussed.

45394 **Cavity nucleation at grain boundary ledges.** Chan, K.S.; Page, R.A.; Lankford, J. (Southwest Research Institute, San Antonio, TX (US)). *Acta Metallurgica;* **34**: No. 12, 2361-2370(Dec 1986).

The kinetics of cavity nucleation at grain-boundary ledges is examined for ceramics subjected to compressive loads. By considering grain boundary sliding and diffusion as concurrent processes, the analysis shows that sliding of faceted grain boundaries can induce time-dependent stress concentrations of sufficient magnitude to cause cavity nucleation at the ledges. The transient stress concentration has been found to depend on the ledge height and spacing, and to decrease rapidly with time and with distance from the ledge. Whether or not cavity nucleation occurs at the ledge depends on the local stress, the shape of the critical nucleus, and the characteristic time for cavity formation. The theoretical results are discussed in conjunction with nucleation rate measurements obtained for a sintered alumina using small angle neutron scattering.

45395 **Diffraction effects from internal interfaces-II. Interphase interfaces.** Vitek, J.M.; Ruhle, M. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Acta Metallurgica;* **34**: No. 11, 2095-2104(Nov 1986).

The diffraction effects normal to an interphase interface were evaluated using the approach described in Part I. The model used consisted of two perfect crystals with different lattice spacings joined by an intermediate interface zone. Three different variations for the change in lattice spacing in the interface zone are considered. Diffraction profiles were calculated as a function of the mismatch between perfect crystals and the size of the intermediate region. The effect of faceting at the interface is also considered. A comparison of the calculated profiles with experimental results in the literature on the Mo/Mo/sub 2/C interface structure indicated that a thin crystal of constant spacing may exist at the interphase interface.

45396 **Diffraction effects from internal interfaces-I. General considerations and grain boundary effects.** Vitek, J.M.; Ruhle, M. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Acta Metallurgica;* **34**: No. 11, 2085-2094(Nov 1986).

Diffraction profiles in the direction normal to a planar interface have been evaluated. Diffraction intensities were calculated for the entire diffracting volume, consisting of a distorted interface zone surrounded by two perfect crystals. General features of the model applicable to any type of interface are presented. The case of a twist grain boundary with an exponential lattice expansion at the interface is treated in detail. The effect of facetting at the grain boundary is also considered. An expansion in planar spacing results in an asymmetric broadening of the principal Bragg reflections. However, no simple quantitative relationship exists between the width of the distorted interface region and the resultant streak length in diffraction. The calculations are compared to results in the literature on diffraction effects at gold, and nickel oxide twist grain boundaries.

45397 **The nature of dispersed phases in Ti-0.7 at .% Er prepared by rapid solidification processing.** Konitzer, D.G.; Stanley, J.T.; Loretto, M.H.; Fraser, H.L. (Dept. of Metallurgy and the Materials Research Lab., Univ. of Illinois, 1304 W. Green Street, Urbana, IL 61801 (US)). *Acta Metallurgica;* **34**: No. 7, 1269-1278(Jul 1986).

Specimens containing oxygen concentrations above and below that required to combine with the Er to form Er/sub 2/O/sub 3/ were laser melted and heat-treated. These precipitates are two different forms of cubic Er/sub 2/O/sub 3/ which, while having slightly different lattice parameters, form coherently with the Ti matrix with two different orientation relationships. Some larger precipitates are carbides and incoherent Er/sub 2/O/sub 3/.

45398 **Transient stresses in bimodal compacts during sintering.** De Jonghe, L.C.; Rahaman, M.N.; Hsueh, C.H. (Materials and Molecular Research Div., Lawrence Berkeley Lab., and Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA (US)). *Acta Metallurgica;* **34**: No. 7, 1467-1474(Jul 1986).

A method is described to evaluate the transient stresses in a sintering compact of ZnO containing a hard, dense dispersion of SiC. A hard second phase can limit densification rates by generating a mean hydrostatic stress, σ/sub h/, which opposes the compressive sintering stress of the matrix. σ/sub h/ increases with increasing volume fraction, f, of the second phase. The interface stress, σ/sub i/, at the ZnO/SiC boundary increases with decreasing f. σ/sub i/ can attain large values, especially in intermediate sintering. The effect of these stresses on microstructural development is considered.

45399 **Toughening of brittle solids by martensitic transformations.** Evans, A.G.; Cannon, R.M. (College of Engineering, Univ. of California, Santa Barbara, CA (US)). *Acta Metallurgica;* **34**: No. 5, 761-800(May 1986).

A review of toughening mechanisms in transformable brittle solids is presented. Primary emphasis is given to transformation toughening, although microcrack and deflection toughening are also considered. Models of toughness are developed using concepts from applied mechanics, but within the context of the thermodynamics and kinetics of the transformation process. The predictions are compared with experimental data for various ZrO/sub 2/ containing ceramic alloys. The predominant toughening mechanism depends on composition and microstructure; dilatational transformation toughening with shear modifications dominates in partially stabilized zirconia; uniaxial transformation and microcrack mechanisms prevail in zirconia alumina; transformation toughening with partial reversibility in tetragonal zirconia polycrystals.

3606 Other Materials

REFER ALSO TO CITATION(S) 44606, 44607, 44894, 44907, 45021, 45041, 45092, 45266, 45274, 45340, 45363, 45386, 45473, 45548, 45549, 45550, 45636, 45637, 45642

45400 **(AD-A—192306/9/XAB) NDP (neutron depth profiling) evaluations of boron-implanted compound semiconductors.** Bowman, R.C.; Knudsen, J.F.; Downing, R.G. (Aerospace Corp., El Segundo, CA (USA). Laboratory Operations). 4 Mar 1988. 93p. (TR—0086A(2945-07)-3). NTIS, PC A05/MF A01.

This report describes recent neutron depth profiling (NDP) experiments on the distribution of implanted boron in several semiconductors. The objectives are to compare the boron profiles for different materials that had been simultaneously implanted and to assess the effects of annealing treatments that were used to remove implant damage and electrically activate the boron.

45401 **(AD-A—192631/0/XAB) Laser photosublimation of compound semiconductors.** Rothchild, M.; Arnone, C.; Ehrlich, D.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Apr 1987. 9p. (JA—5903). NTIS, PC A02/MF A01.

Pub. in Jnl. of Materials Research, Vol. 2, No. 2, 244-251(Mar-Apr 1987).

Interaction between semiconductor and incident bandgap radiation takes place via electron-hole pair generation. The photogenerated charge carriers may thermalize on a rapid time scale, thereby converting the photon energy into heat and ultimately leading to various thermal processes, including sublimation. Alternatively, nonthermal effects may become dominant if the interaction of charge pairs with the lattice phonons is slower than other charge related processes. The visible-laser sublimation of CdTe, HgCdTe, CdS, and GaAs was studied. A dynamic light guiding was identified with an active feedback mechanism and is connected to the observation of 0.4-micrometer-wide single-mode guiding structures during deep etching. The incipient stages of sublimation were studied by mass spectrometry and are discussed in relation to diffusion mechanisms in the solid state.

45402 **(AD-A—192875/3/XAB) Relationship between radiation sensitivity and redox equilibria. Final report, 1 August 1984-31 October 1987.** Kinser, D.L.; Weeks, R.A. (Vanderbilt Univ., Nashville, TN (USA). School of Engineering). 1 Mar 1988. 6p. NTIS, PC A02/MF A01.

This program examined the role of glass processing upon subsequent radiation effects with particular focus upon optical absorption centers. The results have indicated a number of strategies appropriate for the mitigation of radiation-induced darkening of optical components. The fundamental understanding of the relationship between glass-processing variables and atomic defects in glasses has permitted these advances.

45403 **(AD-A—192922/3/XAB) Preparation and properties of new inorganic glasses and gel-derived solids. Final report, 1 October 1983-30 September 1987.** Mackenzie, J.D. (California Univ., Los Angeles (USA). Dept. of Materials Science and Engineering). Mar 1988. 31p. NTIS, PC A03/MF A01.

Research was carried out on two families of solids. The first involves solids made by the sol-gel process and includes composites; the second involves non-oxide glasses based on fluorides, chalcogenides, and chalcohalides. The structures of oxide gels were studied by x-ray photoelectron spectroscopy, and the gelation of gels investigated as a function of temperature and catalyst. A new theory was developed on gel transformations. A number of new composites made by the sol-gel route were examined, included the using of SiC and diamond powder as fillers and some triphasic solids. The viscosity and viscoelasticity of fluorozirconate glasses and glass fibers were studied. New chalcohalide glasses were prepared and their optical properties evaluated. Structural information was derived from Raman spectra.

45404 **(CONF-880669—7) Conductivity of organic polymers: A nonlinear approach.** Narten, M.D.; Narten, A.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013837/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Organic polymers are usually insulators or semiconductors; only after 7-30% of dopant is added do the materials become conducting. The dopant is not regularly distributed: existing spatial inhomogenuities in the solids become centers of attraction for the dopant, which is then concentrated in conducting areas or zones. A mathematical model is presented in which the conducting regions are considered as conducting zones of various sizes and shapes. These regions are irregularly distributed and imbedded in insulated or semiconducting media, and connected in a nonlinear way. Nonlinear integral equations are derived to describe the conductivity in such materials. Predicted results are in agreement with experimentally measured electric field relaxation curves. 20 refs., 7 figs.

45405 **(CONF-880841—11) Characterization of electron-beam induced damage structures in natural fluorite, CaF{sub 2}, by analytical electron microscopy.** Blake, D.F.; Allard, L.F.; Echer, C.J.; Freund, F. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center; Oak Ridge National Lab., TN (USA); Lawrence Berkeley Lab., CA (USA)). 1988. Contract AC05-84OR21400;AC03-76SF00098. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009706/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Naturally occurring fluorite, CaF{sub 2}, develops a particular highly ordered damage structure when exposed to the primary beam in the transmission electron microscope (TEM). This structure has been variously described as "ordered defect aggregates", a "superlattice array of voids", and "Ca colloids produced by beam-induced loss of fluorine from the fluorite structure." During a reconnaissance study of optical anisotropy in natural fluorite we observed this structure under a variety of instrumental conditions. It is the purpose of this communication to further describe electron-beam induced damage structure in fluorite and to speculate, based upon these new data, as to its mechanism. 14 refs., 3 figs., 1 tab.

45406 **(INIS-mf—11258) Seventh national conference of the South African Section of the PRI.** (Plastics and Rubber Inst., Johannesburg (South Africa). South Africa Section). 1983. 359p. (CONF-8311174—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88703269/JAW.

From 7. national conference of the South African section of the Plastics and Rubber Institute; Johannesburg, South Africa (10 Nov 1983).

This publication contains the papers delivered at the 7th national conference of the South African Section of the Plastics and Rubber Institute held on the 10th and 11th November 1983 in Johannesburg. This papers cover information on the various applications of rubber and plastic and other organic polymers. One of this papers look at studies in cross-linking PVC footwear soling compounds using gamma-irradiation.

45407 (INIS-mf—11258, pp 13) **Studies in cross-linking PVC footwear soling compounds using gamma-irradiation.** Bloom, L.I. (AECI Chlor-Alkali and Plastics Limited, South Africa). 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88703269/JAW. (CONF-8311174—).

From 7. national conference of the South African section of the Plastics and Rubber Institute; Johannesburg, South Africa (10 Nov 1983).

Irradiation cross-linking of polymeric materials has been known for some time but it is only in recent years that it has been put to commercial advantage. Well known uses are the modification of PVC for high temperature applications such as underbonnet wiring, stove wiring, post office telecommunication wire and shrink tubing. In South Africa interest in developing commercial applications for cross-linkable polymeric materials was initially stimulated through the work of the Atomic Energy Board at Pelindaba in late 1971 using a cobalt - 60 gamma radiation unit.

45408 **(LBL—25171) Microstructural evolution of an iron silicate catalyst with thermal and hydrothermal treatments.** Csencsits, R. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 2p. (CONF-880841—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010786/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Iron silicate analogs of the zeolite ZSM-5 may be directly synthesized from iron silicate gels in a manner which differs slightly from the alumino-silicate ZSM-5. The resultant white, crystalline iron silicate is referred to as FeZSM-5 in the as-synthesized form. Thermal treatment removes the organic crystal-directing agent and moves some of the framework iron into non-framework sites producing the calcined form of the molecular sieve FeZSM-5. Scanning electron microscopy (SEM) was used to characterize the overall molecular sieve particle sizes and morphologies as a function of preparation conditions. Transmission electron microscopy (TEM) was used to follow the microstructural changes in the iron silicate molecular sieve as a function of synthesis and treatment conditions. 4 refs., 2 figs.

45409 (LBL—25172) X-ray emission spectroscopy study of iron silicate catalyst FeZSM-5. Csencsits, R.; Lyman, C.E.; Gronsky, R. (Lawrence Berkeley Lab., CA (USA); Lehigh Univ., Bethlehem, PA (USA). Dept. of Materials Science and Engineering). Mar 1988. Contract AC03-76SF00098;FG02-86ER45269. 2p. (CONF-880841—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010363/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Iron silicate analogs of the zeolite ZMS-5 may be directly synthesized from iron silicate gels in a manner which differs slightly from the alumino-silicate ZSM-5. The resultant white, crystalline iron silicate is referred to as FeZSM-5 in the as-synthesized form. Thermal treatment removes the organic crystal-directing agent and moves some of the framework iron into non-framework sites producing the calcined form of the molecular sieve FeZSM-5. Homogeneity in the distribution of catalytic iron throughout the particles is desired in an optimal catalyst. Distribution of the iron throughout the framework in the as-synthesized forms would affect the final distribution of catalytic iron in the calcined and steamed forms; thus, the iron distribution throughout the as-synthesized and calcined forms of FeZSM-5 were studied using the high spatial resolution on the analytical electron microscope. 7 refs., 3 figs.

45410 (NP—8770331) Contribution to the development of formed and unformed refractory materials for coal gasification plants, with particular regard to material characteristics and wear. Eisenbach, B. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 16 May 1986. 229p., (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88770331/JAW.

Formed and unformed refractories for applications in coal gasification plants were produced, i.e. bricks based on the spinels picrochromite (MgCr/sub 2/O/sub 4/) and magnesium aluminate (MgAl/sub 2/O/sub 4/), pure picrochromite bricks and Cr/sub 2/O/sub 3/-enriched picrochromite bricks. Further experimental bricks consisted of CaO-statilized ZrO/sub 2/ and MgAl/sub 2/O/sub 4/. Technological data, e.g. open porosities, raw densities, the hot bending strength, the V modules, and the pressure creep characteristics, were determined by light microscopy, radiography, and SEM. Thermal conductivities, dilatometric expansion, and hot abrasion were measured in selected experimental bricks. The slagging resistance of the bricks was tested in drum furnaces and kilns, using acid and base slag. The wear mechanism were determined on the basis of optical structural changes and by analyzing the reaction products identified by radiography and REM.

45411 (ORNL/TM—10590) New applications of silicon micromachining. Lauf, R.J.; Wood, R.F.; Fleming, P.H.; Bauer, M.L. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013502/JAW.

The use of photolithography and anisotropic etching of silicon wafers to make strong, thin membranes has created a large family of miniature sensing devices such as pressure transducers and accelerometers. This report describes several entirely new devices in which silicon membranes are used for their strength and for their transparency to certain kinds of radiation. Two applications are described: a rugged alpha detector and a fluid sample cell for small-angle x-ray scattering. 8 refs., 12 figs., 2 tabs.

45412 (PB—88-183785/XAB) Analysis of translaminar ruptures on cross-piled composites. Odorico, J.; Vancon, M.; Bard, A. (Societe Nationale Industrielle Aerospatiale, 92 - Suresnes (France). Lab. Central). 6 Aug 1987. 85p. (In French). (PROCES-VERBAL—48/447/F). NTIS, PC E05/MF E05.

The study was done on samples with lateral cuts draped into 14 folds of carbon epoxy T300-5208. Two drapings were investigated: quasi-isotropic and plus or minus 45 degrees. The damages caused at the bottom of the cut under static and cyclic traction stress were observed in the course of the tests so as to clearly understand their onset and development. Several methods were tested for the purpose: visual inspection, acoustic emission, thermography, acoustic microscopy, radiography. An analysis of the damages via micrography made it possible to arrive at useful criteria for appraisals so as to determine the sites of onset and the mode and sense of propagation.

45413 (PB—88-215421/XAB) Round-robin measurements of the apparent thermal conductivity of two refractory insulation materials, using high-temperature guarded-hot-plate apparatus. Hust, J.G.; Smith, D.R. (National Bureau of Standards, Boulder, CO (USA). Chemical Engineering Science Div.). Apr 1988. 31p. (NBSIR—88/3087). NTIS, PC A03/MF A01.

This report presents the test results and analysis of round-robin measurements of apparent thermal conductivity for two kinds of refractory insulation board using high-temperature guarded-hot-plate apparatus. The round robin was carried out under the sponsorship of the American Society for Testing and Materials (ASTM) Subcommittee C-16.30 on Thermal Measurements. To complete the measurement program in a timely manner, the participants chose to measure different specimens, selected, however, from the same production lot. The test results for apparent thermal conductivity illustrate the inter-laboratory reproducibility as well as the temperature and density dependence. The data include the temperature range from 297 to 773 K. The standard deviation is 7.4% for the 48 test results reported by seven participating laboratories for fibrous alumina-silica. The standard deviation is 8.0% for the 58 test results reported for calcium silicate.

45414 (UCID—21384) Survivability of coatings: Program review, Passive survivability review meeting, December 8, 1987. Rathkopf, J.A. (ed.). (Lawrence Livermore National Lab., CA (USA)). 11 Mar 1988. Contract W-7405-ENG-48. 120p. (CONF-871298—). NTIS, PC A06. Order Number DE88009863/JAW.

From Passive survivability review meeting; Livermore, CA, USA (8 Dec 1987).

This report is a compilation of slightly edited transcipts of remarks presented at the Passive Survivability Review Meeting held December 8, 1987 at Lawrence Livermore National Laboratory by members of LLNL's Survivability of Coatings Program. Topics include : survivability of coatings program; computing x-ray effects in optics; x-ray effects in optics; film deposition and status; damage characterization; and quantitative damage measurements. 10 refs., 69 figs.

45415 (UCRL—21055) Thermochemistry of uranium compounds: XVI, Calorimetric determination of the standard molar enthalpy of formation at 298.15 K, low-temperature heat capacity, and high-temperature enthalpy increments of $UO_2(OH)_2$ {center←dot} H_2O (schoepite). Tasker, I.R.; O'Hare, P.A.G.; Lewis, B.M.; Johnson, G.K.; Cordfunke, E.H.P. (Lawrence Livermore National Lab., CA (USA); Argonne National Lab., IL (USA)). Aug 1987. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010715/JAW.

Three precise calorimetric methods, viz., low-temperature adiabatic, high-temperatuare drop, and solution-reaction, have been used to determine as a function of temperature the key chemical thermodynamic properties of a pure sample of schoepite, $UO_2(OH)_2$ {center←dot} H_2O. The following results have been obtained at the standard reference temperature T = 298.15 K:standard molar enthalpy of formation Δ/sub f/H/sub m/°(T) = {minus}1825.4 +- 2.1 kJ mol/sup {minus}1/; molar heat capacity C/sub p,m/°(T) = 172.07 +- 0.34 JK/sup {minus}1/; and the standard molar entropy S/sub m/°(T) = 188.54 +- 0.38 JK/sup {minus}1/ mol/sup {minus}1/. The molar enthalpy increments relative to 298.15 K and the molar heat capacity are given by the polynomials: {H{sub m}-{sup 0}(T) {minus} H{sub m}-{sup 0}(298.15 K)}/(J mol/sup {minus}1/) = {minus}38209.0 + 84.2375 (T/K) + 0.1472958 (T/K)² and C/sub p,m/°(T)/(JK/sup {minus}1/ mol/sup {minus}1/) = 84.238 + 0.294592 (T/K), where 298.15 K < T < 400 K. The present result for Δ/sup f/H/sub m/° at 298.15 K has been combined with three other closely-agreeing values from the literature to give a recommended weighted mean Δ/sub f/H/sub m/° = {minus}1826.4 +- 1.7 kJ mol/sup {minus}1/, from which is calculated the standard Gibbs energy of formation Δ/sub f/G/sub m/°

= {minus}1637.0 +- 1.7 kJ mol/sup {minus}1/ at 298.15 K. Complete thermodynamic properties of schoepite are tabulated from 298.15 to 423.15 K. 19 refs., 6 tabs.

45416 **Sudden impact probing submicrosecond shock waves.** Chhabildas, L.C.; Graham, R.A. (Thermomechanical and Physical Div., Sandia National Labs., Albuquerque, NM (US)). *Mechanical Engineering;* **110**: No. 5, 40-51(May 1988).

Analysis of high-impact loading is essential in basic materials science; applications range from the protection of spacecraft from meteoroids and the design of advanced weaponry and armor to the safety engineering of nuclear reactors and the explosive forming and welding of metals. Shock-compression science and engineering has undergone a steady growth since World War II. The instruments, devices, and gauges used to detect the stress-wave profiles of shock waves have played a leading role in the development of the technology, yet their characteristics have received little critical scrutiny. Although few truly new detectors have been developed in the past ten years, much has been learned about gauge techniques. This article will survey the measurement techniques used to study the stress pulses or shock waves that result from rapid impulsive loading.

45417 **Interaction of slip with grain boundary and its role in cavity nucleation.** Yoo, M.H.; Trinkaus, H. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Acta Metallurgica;* **34**: No. 12, 2381-2390(Dec 1986).

Localized stress evolution resulting from interaction of slip with a grain boundary is characterized by a superposition of the internal loading of a subsystem by dynamic dislocation pile ups and the diffusional relaxation along the grain boundary. The probability of cavity nucleation per stress pulse is evaluated. The nominal efficiency of a grain boundary as a vacancy source and sink is related to the climb mobility of grain boundary dislocations. The critical stress for cavity nucleation (a Hall-Petch type relationship) is related to the effective slip length. The frequency of slip/grain-boundary interaction and continuous cavity nucleation during creep are discussed by comparing theoretical predictions with experimental data.

45418 **Computer simulation of recrystallization-I. Homogeneous nucleation and growth.** Srolovitz, D.J.; Grest, G.S.; Anderson, M.P. (Los Alamos National Lab., Los Alamos, NM (US)). *Acta Metallurgica;* **34**: No. 9, 1833-1846(Sep 1986).

A Monte Carlo computer simulation technique in which a continuum system is modeled employing a discrete lattice has been applied to recrystallization. Primary recrystallization is modeled under conditions where the degree of stored energy is varied and nucleation occurs homogeneously. The nucleation rate is chosen as either constant or site saturated. The recrystallized volume fraction shows sigmoidal variations with time. The data are approximately fit by the Johnson-Mehl-Avrami equations; however, deviations are observed for small and large recrystallized volume fractions. Under site saturated nucleation conditions, the microstructure is initially characterized by the growth of individual recrystallized grains which grow until impingement leaving pockets of unrecrystallized grains and a bimodal grain size distribution. These pockets then recrystallize, often leaving elongated, irregular grains with a relatively homogeneous distribution of grain sizes. When nucleations occurs at a constant rate, propensity for irregular gain shapes is decreased and the density of two sided grains increases. The final recrystallized grain size (area) is proportional to the nucleation rate to the (-2/3) power.

45419 **Intergranular creep cavitation with time-discrete stochastic nucleation.** Fariborz, S.J.; Harlow, D.G.; Delph, T.J. (Dept. of Mechanical Engineering and Mechanics, Lehigh Univ., Bethlehem, PA (US)). *Acta Metallurgica;* **34**: No. 7, 1433-1442(Jul 1986).

An empirical model is proposed. Based upon experimental evidence, the mean function of the Poisson process is taken to be a power law function of time. The model is implemented in conjunction with a recent analysis which treats the growth of randomly spaced populations of voids in a simplified bicrystal configuration. Numerical simulations indicate that the times-to-failure and cavity radii are distributed according to a Weibull cumulative distribution function. Both predictions have experimental support. The presence of nucleation reduces the time-to-failure by creep rupture by a factor of two to eight compared to simulations without nucleation.

45420 **Response function analysis of time-dependent diffusional defect processes.** Brailsford, A.D.; Mansur, L.K. (Ford Motor Co., Dearborn, MI (US)). *Acta Metallurgica;* **34**: No. 7, 1303-1306(Jul 1986).

The loss rate of defects to cavities in a material subject to spatially uniform but arbitrarily time-dependent irradiation is re-derived by means of response function theory. The result coincides with an earlier derivation.

45421 **Computer simulation of dislocation glide-II. Comparison with experiments.** Altintas, S.; Morris, J.W. Jr. (Dept. of Mechanical Engineering, Bogazici Univ., Istanbul (TR)). *Acta Metallurgica;* **34**: No. 5, 809-816(May 1986).

The authors consider the glide of a single dislocation through randomly distributed obstacles of given properties. Using a model, the authors studied the critical resolved shear stress for a thermal glide and the velocity of thermally activated glide at finite temperature as functions of the nature and strength of the obstacles. Results are compared with experimental data and good agreement is found.

45422 **Computer simulation of dislocation glide-I. Comparison with statistical theories.** Altintas, S.; Morris, J.W. Jr. (Dept. of Mechanical Engineering, Bogazici Univ., Istanbul (TR)). *Acta Metallurgica;* **34**: No. 5, 801-808(May 1986).

The planar glide of a dislocation through randomly distributed obstacles is considered. Computer simulation studies of dislocation motion through large arrays (containing up to 10/sup 6/ obstacles) are compared with theoretical predictions. Critical resolved shear stress decreases as the size of the array increases.

45423 **Creep rupture in materials containing an amorphous phase.** Thouless, M.D.; Evans, A.G. (Materials and Molecular Research Div., Lawrence Berkeley Lab. and Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA (US)). *Acta Metallurgica;* **34**: No. 1, 23-32(Jan 1986).

Experimental observations of creep rupture in materials containing an amorphous second phase are presented. Based on these and other observations, a theoretical model is developed for a dominant aspect of rupture: creep crack growth. According to the model the crack extends into a damage zone consisting of cavities in the second phase. Two limiting solutions are presented. One occurs when cavity growth is unaffected by the constraint of the surrounding matrix; the crack velocity is dominated by the properties and dimensions of the intergranular phase. In the other limit, the constraint is dominant and bulk viscosity exerts an essential influence on crack growth rate.

45424 **Growth and characterization of Nd,Cr:GSGG laser crystals.** Kueny, A.W.; Creamer, J.E.; Dawes, D.G.; Randles, M.H. (Synthetic Crystal Products, 1201 Continental Boulevard, Charlotte, NC (US)). pp 38-44 of Laser and nonlinear optical materials. De Shazer, L.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860880—).

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

The growth and characterization of Nd,Cr:GSGG crystals for laser applications is described.

45425 **Direct assessment of the phase matching properties of new nonlinear materials.** Velsko, S.P. (Nonlinear Optical Materials Group, Lawrence Livermore National Lab., P.O. Box 808, L-490, Livermore, CA (US)). pp 25-30 of Laser and nonlinear optical materials. De Shazer, L.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860880—).

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

Direct measurements of the phase matching properties of small (submillimeter) crystals of some new second and third harmonic generators is discussed. Such measurements represent an intermediate level of characterization between powder tests and detailed dispersion and d coefficient determinations. Since crystals as small as 300 microns may be studied, a decision to pursue a material can be made at an early stage of crystal growth. Representative data on some new fluoride harmonic generators is presented.

45426 **Faraday rotator materials for laser systems.** Weber, M.J. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, Livermore, CA (US)). pp 75-90 of Laser and nonlinear optical materials. De Shazer, L.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860880—).

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

Materials exhibiting strong Faraday rotation are of interest for numerous laser and other applications. The characteristics of diamagnetic, paramagnetic, and ferromagnetic Faraday rotator materials for use in different spectral regions are described; both crystals and glasses are included. Properties of selected materials and relative figures of merit for various applications are also presented.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 44595, 44694, 44696, 44967, 44977, 44978, 44979, 45050, 45051, 45375, 45643, 45706, 45787, 45821, 45877

45427 **(ENEA-RT-COMB—87-14) Determination of alpha-emittimg nuclides of thorium and uranium in soil and sediment samples.** Spezzano, P.; Silvestri, N. (ENEA, Rome (Italy)). Mar 1988. 15 p. (CONF-870994—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754255/JAW.

From 6. conference on chemistry for protection of the environment; Torino, Italy (15 Sep 1987).

A procedure, for the radiochemical determination of Th(228), Th(230), Th(232), U(234), U(235) and U(238) in soil and sediment samples, is described. The analytical method is based on the decomposition of the sample by a fluoride-pyrosulphate fusion technique to allow total dissolution and chemical exchange between natural isotopes and added yield tracer nuclides. Uranium and thorium are coprecipitated as hydrolyzable metals with natural Fe and Al acting as carriers. Separation of thorium and uranium is by reversed-phase chromatography using a column filled with Microthene impregnated with tri-n-octylphosphine oxide (TOPO) as the stationary phase followed by final purification by anion exchange chromatography. Each fraction is electrodeposited and final measurements are made by alpha spectrometry with a surface barrier detector. Overall chemical yields are generally better than 60%. For individual isotopes, the lower limit of detection, at the 95% confidence level, is 10(-3) becquerels/g for a counting time of 1000 min. One of the most important applications of the present procedure is its use in environmental monitoring, particularly in the vicinity of nuclear facilities and uranium mills, and in the study of the distributions and geochemical behaviours of natural actinides.

45428 (EPRI/EA/EL—5612, pp 7.1-7.8) **Analytical and sampling techniques for determination of ultratrace quantities of polychlorinated dibenzofurans and dibenzodioxins.** Cooke, M.; Hatchel, J.A.; Czuczwa, J.M.; Degner, K. (Battelle Memorial Institute, Columbus, OH (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The US Environmental Protection Agency (US EPA) promulgated the Fire Rule to address the risks posed by uncontrolled fires that involve high levels of PCB, situations where PCDF (or PCDD) might be formed in significant amounts. Exposure of PCB to a building fire can occur when Askarel-containing transformers are present at the fire site. Recognition of the risks posed by formation of PCDF/PCDD has prompted most utilities to remove PCB from active service by either replacing or retrofilling existing appliances. To demonstrate the environmental safety of a recently designed facility for handling large amounts of PCB, a Toxic Substances Control Act (TSCA) demonstration test was conducted in September 1986. This paper describes the sampling and analytical procedures that were used to measure PCDF/PCDD levels in the liquid process streams handled at the plant and gaseous emissions generated in the decontamination process. Results demonstrate the sensitivity and reliability of ultratrace sampling and analysis methods for these levels. 2 references, 2 figures, 6 tables.

45429 (EPRI/EA/EL—5612, pp 7.36-7.42) **Interlaboratory comparison of PCOD and PCDF analysis.** Pellizzari, E.D.; Perritt, K.; Hartwell, T. (Research Triangle Institute, Research Triangle Park, NC (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A statistical analysis of interlaboratory data from five laboratories was performed to assess the accuracy and precision of analysis for selected PCDD and PCDFs in three baseline and seven in-service utility samples. Comparisons are made by compound, sample type, and laboratory. 5 references, 5 tables.

45430 (EPRI/EA/EL—5612, pp 10.8-10.13) **Increasing the accuracy of the GC/ECD and GC/HECD quantitation of PCBs using a new PCB analytical standard.** Turner, S.T.; Scuderi, R. (Midwest Research Institute, Kansas City, MO (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Polychlorinated biphenyls (PCBs) present a difficult challenge to the analytical chemist. There are 209 forms of the PCB molecule and each form (isomer) is different in its effect on the common analytical detection systems presently available. This difference in effect by each isomer on the analytical detection systems, combined with the wide variety of isomers often encountered in PCB-contaminated samples, can make the accurate measurement of PCBs a difficult task. To address this problem, the possibility of a new analytical standard mixture is investigated, and results are summarized briefly. 3 references.

45431 (EPRI/EA/EL—5612, pp 10.22-10.25) **Field determination of PCB in ground cover.** Gonzalez, L.A.; Ferrie, J.S. (Ontario Hydro Research Div., Toronto (Canada)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A reliable and quick method to determine if ground cover contains chloride equivalent to that in 50 or more mg/kg of PCB-contaminated solid was developed. The method is based on a solvent-extraction technique and a subsequent testing of the solvent extract with the commercially available Clor-N-Oil 50 PCB kit. The test procedure was adjusted to give a positive response to soils contaminated with 50 mg/kg of Aroclor 1242. The method has been successfully applied to soils of different types. It requires however, minimum reagent and sample temperatures of 15°C, and predrying of the solids if water content is greater than 30 g/kg. The use of this test method after a PCB spill occurrence will reduce the growth rate of PCB-contaminated solids stored in Ontario Hydro locations. 3 references, 1 table.

45432 **(INIS-BR—1109) First results of beryllium detection using the berylometer in Serra Branca, Cavalcante, Goias.** Drummond, D.; Mello, F.J.C.; Silva, R.J.; Goncalves, J.H. (Sociedade Brasileira de Geologia, Sao Paulo). 1986. 5p. (In Portuguese). (CONF-8610278—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703210/JAW.

From 34. Brazilian congress of geology; Goiania, Brazil (12 Oct 1986).

The berylometer is a portable tool, used to detect berylium minerals in soil or rocks. It has an antimony 124 source of gamma ray, and it measures the neutron radiation produced by the irradiated mineral. This paper presents the field mapping results using berylometer at Serra Branca, Cavalcante, Goias.

45433 **(INIS-BR—1129) Fractionation of carbon and oxygen of the carbonates from corals in the Bahia State, Brazil.** Azevedo, A.M.R. de. (Bahia Univ., Salvador (Brazil)). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703230/JAW.

45434 **(INIS-BR—1166) Technological characterization of phosphate from Patos de Minas (MG-BR) state of Brazil due the processing of calcined thermophosphate production.** Lima Neto, N.; Secco, V.; Silva, Gil A. da. (Sao Carlos Univ. (Brazil); Sao Paulo Univ. (Brazil)). (Sao Carlos Univ. (Brazil). Dept. de Engenharia Quimica). 1986. 1p. (CONF-8607372—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703568/JAW.

From 7. Brazilian congress on chemical engineering; Rio de Janeiro, Brazil (1 Jul 1986).

45435 **(INIS-BR—1176) General group force field and vibrational mode coupling of ZnX/sub 2/.2CH/sub 3/CN and ZnX/sub 2/. 2CD/sub 3/CN (X=Cl, Br, I).** Hase, Y. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1987. 1p. (CONF-8711208—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703578/JAW.

From 4. Brazilian symposium on theoretical chemistry; Caxambu, Brazil (8 Nov 1987).

45436 **(INIS-mf—11266) Abstracts of IAA 87 conference on instrumental activation analysis.** Vobecky, M.; Obrusnik, I. (eds.). (Ceskoslovenska Spektroskopicka Spolecnost, Prague). Aug 1987. 32p. (In Czech, and Slovak). (CONF-8709317—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703272/JAW.

From IAA '87: conference on instrumental activation analysis; Rakovnik, Czechoslovakia (7 Sep 1987).

The presented papers deal with the use of activation analysis in the determination of elements in soils, minerals, aerosols, biological and plant materials and in monitoring the purity of chemicals, testing reference materials and determining radionuclides in building materials; also with the problems of gamma spectroscopy in neutron activation analysis, the testing of the characteristics of high-purity Ge detectors, energy calibration of multichannel analyzers, etc. (E.S.). 1 ref., 1 fig.

45437 **(INIS-mf—11784) Trace element determination in fingernails, hair and blood serum in patients with Crohn's disease using neutron activation analysis.** Buschmann, H. (Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet). 5 Apr 1984. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754337/JAW.

The determination of trace elements and electrolyte concentrations in blood serum, hair and fingernails of 16 patients with Crohn's disease was carried out by means of instrumental neutron activation analysis. In the serum a significant decline in the zinc content could be registered, while the remaining trace elements remained in the normal range. The parenteral nutrition also showed a zinc deficiency. There was, however, also an iron deficiency. The studies of the hair and fingernails gave the following results: Rubidium and antimony in the normal range; zinc, selenium, iron and cobalt below normal values.

45438 **(JINR—18-87-694) Determination of coal composition INAA, IGAA and XRF methods.** Sodnom, N.; Gehrbish, Sh.; Maslov, O.D.; Gavrilov, K.A.; Belov, A.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702901/JAW.

Submitted to the Khim. Tverd. Topl.

Methods of the elemental analysis (instrumental neutron activation anlysis-INAA, instrumental gamma-activation analysis-IGAA and x-ray fluorescence analysis - XRF) of coals is described, and the comparative results are presented. It is shown that the use of microtron permits to determine more than 40 elements which are of interest for industry and ecology with 10/sup -3/-10/sup -5/% detection limit. 8 refs.; 6 figs.; 2 tabs.

45439 **(LBL—25009) Fourier transform infrared spectrometry of ambient aerosols.** Pollard, M.; Jaklevic, J. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014051/JAW.

Fourier transform infrared (FTIR) spectrometry has been evaluated as a method for determining the concentration of selected species present in ambient aerosols collected on Teflon filters. The filters are analyzed by transmission measurements after collection of the fine fraction (< 2.5 μm diameter) of the ambient particles on 2 μm pore size Teflon filters. The spectra of the blank filters are subtracted from the spectra of the loaded filters and the area of the specific absorbance bands for ammonium, nitrate, and sulfate are measured and compared to calibration curves. The filter orientation must be maintained for all measured infrared spectra. 46 refs., 22 figs., 3 tabs.

45440 **(ND-R—1342(D)) Method for the spectrophotometric measurement of traces of plutonium VI in plutonium concentrate solution.** Mair, M.A.; McLennan, C.D.; Savage, D.J. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Northern Research Labs., Risley). Nov 1987. 10p. H.M. Stationery Office, London, price Pound 4.00.

Plutonium VI is measured by spectrophotometric absorption and calculated as a percentage of the total plutonium in solution, obtained by an independent measurement.

45441 **(ND-R—1516(D)) Method for the determination of plutonium in plutonium concentrate solutions by ceric oxidation, ferrous reduction and amperometric titration by dichromate.** Mair, M.A.; MacDonald, A.; Savage, D.J. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Northern Research Labs., Risley). Nov 1987. 15p. H.M. Stationery Office, London, price Pound 4.00.

Plutonium in nitric acid solution is oxidised to plutonium VI by cerium IV. Excess cerium IV is reduced by arsenic III, excess arsenic III is oxidised by manganese VII and excess manganese VII is reduced by oxalate. Plutonium VI is then reduced to plutonium IV by an excess of iron II and the excess iron II is titrated amperometrically with standard potassium dichromate solution.

45442 **(NP—8770320) Investigations into the enrichment of metal ions on chemically modified silica gels, with subsequent X-ray fluorescence measurement.** Luehrmann, M. (Paderborn Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 13 - Chemie und Chemietechnik). 3 Dec 1986. 201p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770320/JAW.

The synthesis of 8-hydroxychinoline immobilized on silica gel was optimized. Fixation of 5-chloromethyl-8-hydroxychinoline to amines covalently immobilized on silica gel surfaces is possible via a simple reaction. For a complex chemical characterisation, the metal uptake capacities and distribution coefficients of Cr, Mn, Co, Ni, Cu, Zn, Cd, Pb and Hg were determined under batch conditions. The metal specificity for different pH values and the influence of pore size on the order of metal ions breakthrough were investigated. An error reduction method using the Compton scattering peak correction was developed for determining the complexed

metals on the silica gel surfaces. The metals showed good enrichment on the modified silica gels.

45443 **(NP—8770339) Simultaneous analysis of chloride, bromide, iodide and boron traces and ion species in water using a mass-spectrometric isotope dilution analysis.** Seewald, H. (Regensburg Univ. (Germany, F.R.). Naturwissenschaftliche Fakultaet 4 - Chemie und Pharmazie). 1986. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770339/JAW.

The author developed a method of MS-IVA for simultaneous detection of Cl/sup -/, Br/sup -/, I/sup -/ and B in water samples, as well as a method for distinguishing the inorganic iodine species, iodide and iodate, from the organic iodine fraction contained in water. The isotope ratios of Br, I and B were measured simultaneously using the La two-band technique. Cl isotope ratios were determined by a Re two-band technique, without La additions. The internal reproducibility of isotope ratios was 0.06 to 0.2% for Cl, 0.07 to 0.1% for Cl, 0.05 to 0.2% for I, and 0.03 to 0.1% for B. The external reproducibility was 0.6% for Cl, 0.2% for Br, 0.3% for I, and 0.4% for B.

45444 **(PNL-SA—15206) Effect of phase ratio and column type on retention in SFC [supercritical fluid chromatography].** Yonker, C.R.; Smith, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1987. Contract AC06-76RL01830. 9p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013119/JAW.

Extensive discussion continues regarding the relative merits of capillary and packed columns for supercritical fluid chromatography (SFC). Columns of interest typically include commercially available 50-μm i.d. capillaries having an {approximately}0.25-μm film thickness and packed columns containing 3-μm or 5-μm diameter developed for HPLC. It has been demonstrated that packed columns can offer advantages in terms of speed because the properties of fluids high linear velocities to be utilized, but the lower pressure drop with open tubular capillary columns allows a greater number of effective theoretical plates through the use of longer columns. Much discussion has centered about the comparison of columns under various operating conditions of practical interest (e.g., pressure programming for capillaries or isobaric operation for packed columns). It is the purpose of this report to show the importance of column phase ratio (i.e., the ratio of stationary to mobile phase volumes. V/sub s/ and V/sub m/, respectively in the selection of columns for specific SFC applications.

45445 **(VW-FMT—8504V/5) Identification of oxygenous polycyclic aromatic hydrocarbons in diesel soot extracts using capillary gas chromatography and a combination of capillary gas chromatography and mass spectrometry.** Schulze, J.; Kiess, H. (comps.). (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung). 5 Apr 1985. 25p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754148/JAW.

The report presents a simple, low-expenditure method of separating extracts of diesel soot particles into specific fractions by a simplified liquid-chromatography purification process in special columns. One of the functions will comprise oxygeneous polycyclic aromatic hydrocarbons (Oxy-PAH) and nitrogenous polycyclic aromatic hydrocarbons (Nitro-PAH). Oxy-PAH and Nitro-PAH are analyzed using capillary gas chromatography with so-called 'fused silica' separation columns and flame ionisation detector (GD/FID), or using on-line coupled positive-ion electron-beam mass spectrometry (GC/MS). The constituents are identified by retention time measurements, and especially on the basis of registered mass spectra. The Oxy-PAH thus characterized belong to four different classes of substances, i.e. ketones, chinones, anhydrides and aldehydes.

45446 **Fluorescence detection of phototoxic psoralens in vegetable products.** Vo-Dinh, T.; White, D.A.; O'Malley, M.A.; Seligman, P.J.; Beier, R.C. (Oak Ridge National Lab., TN (USA)). *Journal of Agricultural and Food Chemistry;* 36: No. 2, 333-337(Mar-Apr 1988). Contract AC05-84OR21400.

This work describes the fluorescence detection of phototoxic psoralens in various vegetables products including celery, lime, carrot, parsley, and spinach. The spectral properties of psoralen, 5-methoxypsoralen, and 8-methoxypsoralen and raw extracts of celery and carrots are discussed in detail. The measurement used a portable fiber optics luminoscope developed for monitoring surface and skin contamination.

45447 **Application of synchrotron radiation to x-ray fluorescence analysis of trace elements.** Gordon, B.M.; Jones, K.W.; Hanson, A.L. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY (US)). pp 102-108 of Laser and nonlinear optical materials. De Shazer, L.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860880—).

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

The development of synchrotron radiation x-ray sources has provided the means to greatly extend the capabilities of x-ray fluorescence analysis for determinations of trace element concentrations. A brief description of synchrotron radiation properties provides a background for a discussion of the improved detection limits compared to existing x-ray fluorescence techniques. Calculated detection limits for x-ray microprobes with micrometer spatial resolution are described and compared with experimental results beginning to appear from a number of laboratories. The current activities and future plans for a dedicated x-ray microprobe beam line at the National Synchrotron Light Source (NSLS) of Brookhaven National Laboratory are presented.

45448 **Fourier transform infrared spectroscopy.** Ferraro, J.R.; Basile, L.J. Orlando, FL; Academic Press Inc. (1985). 406p. Academic Press Inc., Orlando, FL 32887.

The final and largest volume to complete this four-volume treatise is published in response to the intense commercial and research interest in Fourier Transform Interferometry. Volume 4 introduces new information on, for example, applications of Diffuse Reflectance Spectroscopy in the Far-infrared Region. The editors place emphasis on surface studies and address advances in Capillary Gas Chromatography-Fourier Transform Interferometry.

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REFER ALSO TO CITATION(S) 44599, 44824, 44974, 45146, 45208, 45375, 45381, 45516, 45670, 45671, 45910, 45919

45449 **(AD-A—192253/3/XAB) Dual chamber injection development (Mark II). Final report, 12 April 1984-15 December 1985.** Monroe, N.; Dietrich, W.C. (Survival Technology, Inc., Bethesda, MD (USA)). 15 Mar 1986. 240p. (STI—21/21). NTIS, PC A11/MF A01.

This report describes final development, submission of NDA, and mass production of Antidote Kit, Nerve Agent, Mark II. It discusses engineering, production, quality control, materials management, and regulatory - clinical efforts. It also includes results of animal and clinical studies and study protocols. A summary of the Technical Data Package and Training Course is presented.

45450 **(BMI/ONWI/C—38) Solubilities and stabilities of nickel species in aqueous solutions: Literature review.** Rizkalla, E.N.; Choppin, G.R. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Florida State Univ., Tallahassee (USA). Dept. of Chemistry). [1988]. Contract AC02-87CH10290. 24p. H. Order Number TI88013299/JAW.

This document describes specific chemical properties of nickel compounds in water. The information sources were published reports rather than experimental data. The information is reviewed as a comprehensive, descriptive report. 4 refs., 3 figs., 12 tabs. (TEM)

45451 **(CEGB-TPRD/B—1028/R88) Chemical characterisation of transition metal spinel-type oxides. Part 2. Manganese-chromium-iron spinels.** Allen, G.C.; Jutson, J.A.; Tempest, P.A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754297/JAW.

Spinel oxides of the type formed on Advanced Gas Cooled Reactor cladding contain manganese, chromium and iron. A range of standard spinels containing these metals have been prepared by solid state reaction of the appropriate single oxides at temperatures of 850/sup 0/C and 950/sup 0/C in atmospheres of CO/sub 2/ or CO/sub 2//2% CO. Each spinel series has been characterised by X-ray diffraction and energy dispersive X-ray analysis. Calibration curves relating lattice parameter to spinel composition have been produced to facilitate the identification of cladding oxides. (U.K.).

45452 **(CONF-8805159—1) Trace substances present as chlorination by-products in drinking and process waters.** Jolley, R.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012923/JAW.

From 22. annual conference on trace substances in environmental health; St. Louis, MO, USA (23 May 1988).

Chlorination is a process commonly used for disinfection of potable water supplies, for the treatment of a variety of process waters such as wastewater and cooling waters, and for many industrial processes such as paper pulp bleaching. Such use is based on the reactive and oxidative properties of aqueous chlorine species in which the chlorine is present at a valence state of plus one (i.e., Cl{sup {plus}} in HOCl or Cl{sub 2}). Both HOCl and Cl{sub 2} are powerful oxidants and appear to be the principal agents responsible for the chlorine substitution reactions. During the last 15 years, increasing attention has been focused on the formation of chloro-organic by-products during the chlorination process, especially in drinking water because of public health concern regarding the toxicological properties of halogenated organics. This paper briefly reviews the chemistry of chlorine germane to the formation of chloro-organics and summarizes some of the more recent developments. 20 refs; 1 fig; 2 tabs.

45453 **(DOE/ER/13774—1) Studies of the fundamental nature of catalytic acidity, sites, and intermediates: Progress report for period August 1, 1987-July 31, 1988.** Hall, W.K. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). Jun 1988. Contract FG02-87ER13774. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012975/JAW.

Neopentane, because of its unique structural features, was found to be a useful probe for the assay of the acidity of various zeolites. The C-C bond was attacked by catalyst protons yielding CH_4 and the isobutyl carbenium ion in equal quantities. The latter either decomposed to produce isobutene or underwent secondary reactions. New avenues for reaction were opened with isobutane. The reaction of the Bronsted protons with the tertiary CH bonds produced H_2 and the same isobutyl carbenium ion. Hydride ion transfer of the same tertiary hydrogen to existing carbenium ions also occurred and the results showed that about half of the reaction was carried by this pathway. As with Neopentane, the C-C bond could also be attacked yielding the sec-propyl carbenium ion. These tools are being further developed.

45454 (EPRI/EA/EL—5612, pp 4.21-4.23) **Use of liquid reagent for in-situ treatment of PCB's in concrete and on surfaces.** Woodyard, J.P.; Zoratto, E.M. (International Technology Corp., Knoxville, TN (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper describes a new development in PCB concrete and other surface decontamination through the use of a liquid-treatment reagent. The reagent, developed in Europe specifically for treatment of chlorinated hydrocarbons, is applied in a heated liquid form and allowed to either penetrate porous surfaces or coat non-porous surfaces. The technique provides a significant advantage in many instances; for concrete it allows destruction of PCB in place without concrete removal, while on metal or other non-porous surfaces it can be used to reduce or eliminate the need for PCB disposal of decontamination residues. The technique has also been used successfully for treatment of dioxin and dibenzofurans, and provides an initial-response tool in PCB transformer fire incidents involving significant levels of these compounds. 1 reference.

45455 (EPRI/EA/EL—5612, pp 4.26-4.31) **Catalytic hydrogenation of polychlorinated hydrocarbons.** Youtsey, K.J.; Hedden, D.R. (UOP Inc., Des Plaines, IL (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The UOP Decontamination process employs catalytic-hydrogenation technology which converts the chlorinated compounds, producing hydrogen chloride and a petroleum derivative. Typically, the petroleum derivative is a reusable product of such value that it offsets the costs to treat the waste material. Depending on the source of the waste oil, its economic value can be recovered by using it as a source of energy (fuel oil); recycling it as a refined intermediate (lube base stock); or, upgrading it as a specialty product (chlorinated benzene to cyclohexane). As well as an economic means of converting contaminated waste oils into reusable products, a properly designed catalytic-hydrogenation process unit eliminates the possibility of releasing products of incomplete conversion into the environment. Process units are designed and constructed to allow certification of products before they are released from the treatment facility. 3 references, 1 figure, 2 tables.

45456 (EPRI/EA/EL—5612, pp 7.27-7.31) **Evaluation of potential health hazards from fires involving liquid and solid utility materials.** Taylor, P.H.; Mazer, S.L.; Tirey, D.A.; Fox, L.; Stalter, J.G.; Dellinger, H.B. (Univ. of Dayton Research Institute, OH (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Concern over the toxicity of PCB fluids has focused on both the major and trace pyrolysis and combustion products and has led to increased attention to the fire toxicity of all materials used in utility applications. To build a data base on the same level as previous PCB degradation studies, it is necessary to perform thermal analyses on all potential substitutes. In this initial study, a laboratory screening approach was applied to the evaluation of toxic pyrolysis and combustion products for a large number of replacement utility fluids. Following the evaluation of the screening data, creosote-treated wood was chosen for in-depth thermal analysis due to the high number and yields of toxic thermal-reaction products produced. This paper discusses the results of these studies and the implications with regard to in-depth thermal analyses of all potential substitutes. 3 references, 2 tables.

45457 **(INIS-BR—1173) Study of trans-/Ru(NH/sub 3/)/sub 4/ P(OEt)/sub 3/ NO//sup 2+/ ion by EPR and infrared in function of NO saturation.** Santos, L.S.; Tabak, M.; Franco, D.W.; Davanzo, C.U. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica; Universidade Estadual de Campinas (Brazil)). (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1985. 1p. (CONF-8512147—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703575/JAW.

From 3. Brazilian symposium on theoretical chemistry; Sao Carlos, Brazil (9 Dec 1985).

45458 **(INIS-BR—1175) Study on molecular geometry of some triatomic hydreto.** Custodio, R.; Takahata, Y. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1987. 1p. (CONF-8711208—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703577/JAW.

From 4. Brazilian symposium on theoretical chemistry; Caxambu, Brazil (8 Nov 1987).

45459 **(Juel—2181) Separation of hydrogen isotopes on molecular sieves by gas adsorption chromatography.** Vogd, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung; Technische Hochschule Aachen (Germany, F.R.)). Feb 1988. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754346/JAW.

Procedures for separating the hydrogen isotopes deuterium and tritium must be made available for fusion experiments. Gas adsorption chromatography represents a possible procedure. The subject of the present paper is therefore the separation of hydrogen isotopes by gas chromatography using the elution technique. The suitability of various adsorbing agents for the separation is first assessed on the basis of defined chromatographic separation values. The application of molecular sieve 5A as an adsorbing agent and helium as carrier gas proves beneficial. A complete separation of the six molecular isotopes H/sub 2/, HD, D/sub 2/, HT, DT and T/sub 2/ can be achieved with this component system in an analytical column of 2 mm ID and 2.5 m length. The influence of facility and operating parameters on the quality of the separation is shown in a parametric study. An approximately linear increase in the gas mixture throughput is associated with an enlargement of the column cross-section. In this way, almost 100 ml of an inactive hydrogen isotope mixture, consisting of H/sub 2/, HD and D/sub 2/ may be separated within 80 min by a preparative column of 12 mm ID and a length of 4 m. The investigations indicate that the separation of hydrogen isotopes on the molecular sieve 5A by gas chromatography can be used both for analytical and preparative purposes. From the preparative point of view, in particular the application on tritiated mixtures with a tritium inventory of up to 10/sup 3/ Ci is conceivable.

45460 **(MLM—3494) Stable isotope sales: Mound customer and shipment summaries, FY 1986.** Kramer, L.R. (ed.); Flayler, K.A. (comp.). (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 20 May 1988. Contract AC04-76DP00053. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013798/JAW.

A listing is given of Mound's sales of stable isotopes of noble gases, carbon, oxygen, nitrogen, chlorine, and sulfur for fiscal year 1986. Purchasers are listed alphabetically and are divided into domestic and foreign groups. Cross-reference indexes by location and by isotope are included for all customers. 3 tabs.

45461 **(NP—8770348) Preparation of 19-iodocholesterol labelled with I-125 and its study as a "tracer" of plasma lipoprotein.** (Universidad de Alcala de Henares, Madrid (Spain). Facultad de Ciencias Quimicas). 1988. 188p. (In Spanish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770348/JAW.

A technique of synthesis of the 19-iodocholesterol lebeled with I-125, modified in some steps from other methods published previously is described. We have obtained a product with high chemical (96%) and radiochemical (99,9%) purities. The yield was higher and the time necessary to prepare it was lower that others methods reported. The study of thermal and radiolytic stability showed that the 19-iodocholesterol-I-125 was not broken by autoradiolysis whereas the I-125 was separated from the molecule when the temperature was increased. The use of this 19-iodocholesterol-I-125 as a tracer of cholesterol of plasma lipoprotein showed some properties of LCAT and CETP and also showed the different capacity of VLDL and LDL to transport cholesteryl esters.

45462 **(UCRL—97985) A kinetic study of ethylene oxidation in a well-stirred reactor.** Westbrook, C.K.; Thornton, M.M.; Pitz, W.J.; Malte, P.C. (Lawrence Livermore National Lab., CA (USA); Washington Univ., Seattle (USA). Dept. of Chemistry; Washington Univ., Seattle (USA). Dept. of Mechanical Engineering). 8 Jan 1988. Contract W-7405-ENG-48. 21p. (CONF-880802—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005623/JAW.

From 22. international symposium on combustion; Seattle, WA, USA (14 Aug 1988).

Experimental results for the oxidation of ethylene in a well-stirred reactor are examined, and the results are analyzed using a numerical model with a detailed chemical kinetic reaction mechanism. Temperatures studied range from 1003k to 1253K, at atmospheric pressure. Comparisons between computer and experimental results show good agreement at temperatures up to about 1200K. However, at higher temperatures, computer rates of ethylene conversion are much higher than those measured. In the range 1200 - 1250K the model predicts effectively complete consumption of the fuel within the given residence time, while the experiments indicate incomplete consumption. These trends, observed previously for n-pentane oxidation in the same well-stirred reactor, are discussed in terms of turbulent mixing and the effects of fluctuations on the rate of fuel consumption in the reactor. 8 refs., 3 figs., 1 tab.

45463 **Metallic versus nonmetallic properties of ternary chalcogenides Ta_2MSe_7 (M = Ni, Pt) and Ta_2NiX_5 (X = S, Se).** Canadell, E.; Whangbo, M.H. (Universite de Paris-Sud, Orsay (France)). *Inorganic Chemistry;* **26**: No. 24, 3974-3976(2 Dec 1987). Contract FG05-86ER45259.

The electronic structures of layered chalcogenides Ta_2NiS_5 and Ta_2NiSe_7 were examined by carrying out tight-binding band calculations. In agreement with experiment, Ta_2NiS_5 and Ta_2NiSe_7 are predicted to be semiconducting and metallic, respectively. The calculated band electronic structures of Ta_2NiS_5 and Ta_2NiSe_7 are best described by the oxidation formalisms $(Ta^{5+})_2$-$(Ni^0)(S^{2-}\pi)_5$ and $(Ta^{5+})_2(Ni^{2+})(Se^{2-})_5(Se_2^{2-})$, respectively. In Ta_2NiS_5, the Ta^{5+} cations act as good π acceptors of each Ni atom, thereby stabilizing its zero oxidation state. The metallic properties of Ta_2NiSe_7 originate from the fact that the bottom d-block band of the octahedral chains overlaps with the top Se p-block band of the trigonal-prismatic chains. The bottom d-block band of the trigonal-prismatic chains is empty, so that the Ta atoms of the trigonal-prismatic chains are not responsible for the metallic properties of Ta_2NiSe_7.

45464 **Chemical properties of radon.** Stein, L. (Chemistry Div., Argonne National Lab., Argonne, IL (US)). pp 240-251 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

Radon is frequently regarded as a totally inert element. It is however, a "metalloid" - an element which lies on the diagonal of the Periodic Table between the true metals and nonmetals and which exhibits some of the characteristics of both. It reacts with fluorine, halogen fluorides, dioxygenyl salts, fluoro-nitrogen salts, and halogen fluoride-metal fluoride complexes to form ionic compounds. Several of the solid reagents can be used to collect radon from air but must be protected from moisture, since they hydrolyze readily. Recently, solutions of nonvolatile, cationic radon have been produced in nonaqueous solvents. Ion-exchange studies have shown that the radon can be quantitatively collected on columns packed with either Nafion resins or complex salts. In its ionic state, radon is able to displace H/sup +/, Na/sup +/, K/sup +/, Ca/sup +/, Ca/sup 2+/, and Ba/sup 2+/ ions from a number of solid materials.

45465 **Comparison of thermodynamic and kinetic measures of solute atom trapping in the Nb-V-O system.** Park, J.; Altstetter, C.J. (Dept. of Metallurgy and Mining Engineering and Materials Research Lab., Univ. of Illinois at Urbana-Champaign, 1304 W. Green, Urbana, IL (US)). *Acta Metallurgica;* **34**: No. 11, 2217-2224(Nov 1986).

Using solid-state electrochemical cells with zirconium sinks, the diffusivity of oxygen was measured across the entire range of Nb/V concentrations. The binding energies calculated according to theoretical models for trapping do not appear to depend on substitutional solute concentration, at least up to 10 at%. Vanadium atoms trap oxygen more strongly in niobium than niobium atoms do in vanadium. The kinetic behavior of oxygen is consistent with the thermodynamic observation that vanadium decreases the activity of oxygen in niobium-rich alloys, whereas niobium has a similar effect but to a smaller degree in vanadium-rich alloys.

45466 **The diffusivity of hydrogen through Pd-based solid solutions containing rhodium and platinum.** Yoshihara, M.; McLellan, R.B. (Dept. of Mechanical Engineering and Materials Science, William Marsh Rice Univ., Houston, TX (US)). *Acta Metallurgica;* **34**: No. 7, 1359-1366(Jul 1986).

An electrochemical technique has been used to measure the diffusivity of hydrogen in solid solutions containing up to 60 at.% Pt and 33 at% Rh in the temperature range 280-360 K. The addition of either substitutional solute decreases the diffusivity of hydrogen. In the Pd-Pt-H system, the kinetic data are in accord with predictions of the cell model and interaction parameters derived from thermodynamic studies.

45467 **Thermodynamic study of ternary nickel-cobalt-hydrogen solid solutions.** Suzuki, Y.; McLellan, R.B. (Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai-Mura, Naka-Gun, Ibaraki-Ken (JP)). *Acta Metallurgica;* **34**: No. 1, 125-130(Jan 1986).

The solubility of hydrogen in f.c.c. solid solutions in equilibrium with H/sub 2/ gas at constant pressure has been measured as a function of temperature (623-1273 K) in the composition range 0-50 at.% Co. The partial thermodynamic functions of the H-atoms dissolved in the substitutional matrix at essentially infinite dilution are in accord with the cell model for ternary solid solutions. Concomitant elastic measurement show that the effect of dilations in the substitutional matrix effected by changes in its composition have only a small effect on partial functions of the H atoms

4004 Electrochemistry

REFER ALSO TO CITATION(S) 44910, 44911, 45093, 45094, 45366

45468 **(AD-A—192805/0/XAB) Modulated surface vibrational spectroscopy at the electrode-solution interface. Technical report.** Ashley, K.; Ponsy, S. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 1985. 10p. (TR—43). NTIS, PC A02/MF A01.

Pub. in Trends in Analytical Chemistry, Vol. 4, No. 6, 142-145(1985).

Infrared spectroelectrochemistry can be used to examine reactions occurring at the electrode/solution interface. This vibrational probe can be applied to study the structure and orientation of molecules and the dynamics of adsorption-desorption processes at the electrode surface.

45469 **(AD-A—192808/4/XAB) Time-resolved infrared spectroelectrochemistry. Technical report.** Pons, S.; Daschbach, J.; Heisler, D. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 1986. 11p. (TR—53). NTIS, PC A03/MF A01.

Pub. in Applied Spectroscopy, Vol. 40, No. 4, 489-491(1986).

Generation of time-resolved infrared spectra of species formed at the electrode-solution interface is reported. The generation of time-resolved infrared spectra of species formed at the electrode-solution interface is reported. The methodology involves electronic pre- or post-coupling of the electrochemical experiment to the interferometer retardation timing. By sorting of the data points in each of the resulting set of interferograms, which are accumulated over finite intervals of time after initiation of the electrochemical experiment, spectra representing very short integrated time periods are obtained. These time-discretized spectra represent the time evolution of the vibrational structure at the electrode surface.

45470 **(AD-A—192809/2/XAB) Infrared spectra of surface-metal atom vibrations. SNIFTIRS studies in the far-infrared region using time-resolved FTIR techniques. Technical report.** Pons, S.; Li, J.; Daschbach, J.; Smith, J.J.; Morse, M.D. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 30 Jul 1986. 12p. (TR—59). NTIS, PC A03/MF A01.

Studies of the vibrations of pure metals have historically been pursued by inelastic neutron scattering (which is sensitive to vibrations of the bulk crystal) and more recently by high-resolution electron-energy-loss spectroscopy. HREELS (which is more sensitive to vibrations of the metal surface). Direct infrared absorbance techniques provide advantages over both of these methods, since they may be used in more hostile environments (such as at the interface between metal and chemical solutions). They have rarely been applied with much success, however, because of the very effective shielding of the electromagnetic radiation by the metal-conduction electrons. This results in an exponential damping of the radiation field as it enters the metal phase, with typical skin depths (1/e damping distances) of only a few tens of nm. This damping improves the sensitivity of infrared-absorption measurements to the surface vibrations as opposed to bulk phonons, but limits the magnitude of the absorbance considerably. This report demonstrates that reflection infrared vibrational spectroscopy may be used to observe the vibrational structure of metallic species deposited on a metal surface which is under electrochemical control.

45471 **(AD-A—192810/0/XAB) In-situ infrared spectroelectrochemistry. Report No. 44. Technical report.** Pons, S.; Foley, J.K. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 30 Jul 1986. 16p. (TR—44). NTIS, PC A03/MF A01.

In-situ infrared (IR) spectroelectrochemistry has become a viable experimental technique only within about the past five years, but it has already proved to be an important addition to the small number of in-situ spectroelectrochemical methods currently in use (electron spin resonance spectrometry, ellipsometry, uv-visible spectrometry,resonance Raman, and surface-enhanced Raman spectrometry),. The technique has found two broad areas of application.

45472 **(AD-A—192815/9/XAB) In-situ infrared spectroelectrochemistry. Report No. 47. Technical report.** Pons, S.; Korzeniewski, C. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 30 Jul 1986. 12p. (TR—47). NTIS, PC A03/MF A01.

The vibrational spectrum of molecules at or near an electrode surface can be obtained using subtractively normalized interfacial Fourier-transform infrared spectroscopy (SNIFTIRS) and electromodulated infrared spectroscopy (EMIRS).

45473 **(NP—8770278) Electrochemical analysis of acceptor graphite intercalation compounds.** Scharff, P. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 20 Feb 1987. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770278/JAW.

The electrochemical characteristics of novel graphite intercalation compounds with metal chlorides and metal nitrides was investigated. Cells constructed specifically for this purpose permitted the use of powdered graphite as electrode material. These electrodes were investigated using cyclic voltammetry, chronoamperometry, cyclic chromoamperometry, and chromopotentiometry. The graphite intercalation compounds were characterized by means of magnetic measurements, Auger electron spectroscopy, optical reflection measurements, X-ray diffraction measurements, ESR measurements, and chemical analyses.

45474 **(NP—8770344) Electrochemical characteristics of MgO/sub 2/.** Nehm, D. (Dortmund Univ. (Germany, F.R.). Abt. Chemie). 29 Nov 1985. 258p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88770344/JAW.

Thermodynamic and kinetic properties of the MgO/sub 2/ electrode are investigated. The electrochemical investigations comprise: a) Stationary measurements on the system MnO/sub 2/H/sub 2/ (with $0 < z < 1$); b) potential jump measurements on the γ MgO/sub 2/ electrode; c) galvanic switch-on and switch-off measurements; d) impedance measurements on MgO/sub 2/ in sulphuric acid solutions; e) permeation and solubility of hydrogen in MgO/sub 2/.

45475 Electrodeposition of microcrystalline chromium from fused salts. (Chemical Technology Div., Argonne National Lab., Argonne, IL (US)). pp 1018-1029 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Chromium can be conveniently electroplated from fused chloride electrolytes. The deposition form LiCl-KCl (eutectic)-CrCl/sub 2/ melts is known to produce large crystal grains. Large grain size and other problems encountered in the electrodeposition of microcrystalline chromium from fused salts are discussed. The results indicate that combined use of forced electrolyte convection and a nucleating pulse in conjunction with a periodic reverse pulse produces fine-grained deposits.

45476 Submerged arc flux welding with CaF/sub 2/-CaO-SiO/sub 2/ fluxes: Possible electrochemical effects on weld metal. Shah, S.; Blander, M.; Indacochea, J.E. (Argonne National Lab., Chemical Technology Div., Materials Science and Technology Program, Argonne, IL (US)). pp 916-927 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Compositional changes of weld metal from welds made by submerged arc flux welding of steel using CaF/sub 2/-CaO-SiO/sub 2/ fluxes are consistent with an electrochemical mechanism in which the filler wire is anodically oxidized to form oxides and fluorides, and metals are cathodically deposited as weld pool-flux interface. This speculative mechanism, if proven by further detailed studies, could make it possible to predict fluxes which will improve the quality of welds.

45477 Spectroscopic and electrochemical studies of molten salt electrolysis of aluminum and magnesium. Yoon, S.Y.; Sadoway, D.R. (Dept. of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA (US)). pp 1011-1017 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Chloride based electrolytes employed in the electrolytic production of aluminum and magnesium have been investigated by laser Raman spectroscopy and cyclic voltammetry. In solutions of composition approximating industrial conditions, aluminum and magnesium exist as tetrahedrally coordinated chloro-complexes, AlCl/sub 4//sup -/ and MgCl/sub 4//sup 2-/, respectively. For both elements the electrodeposition of liquid metal was found to be quasi-reversible.

45478 Electrochemical reactions at the electrode in submerged arc welding. Kim, J.H.; Frost, R.H.; Olson, D.L.; Blander, M. (Center for Welding Research, Dept. of Metallurgical Engineering, Colorado School of Mines, Golden, CO (US)). pp 928-938 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

The submerged arc welding process uses a D.C. arc under a protective slag cover to melt a consumable wire electrode. The purpose of this work is to investigate the relative influence of electrochemical and thermochemical reactions at the surface of the electrode of the composition of the liquid metal droplet. Chemical analyses were carried out on the melted wire electrode tips and on the detached droplets for both reverse polarity (wire is anodic) and straight polarity (wire is cathodic) polarities. The results suggest that both thermochemical and electrochemical reactions are important in altering the composition of the detached droplet.

45479 Ab initio molecular orbital investigation of the structure of Al/sub 2/F/sub 7//sup -/ and Al/sub 2/Cl/sub 7//sup -/. Curtiss, L.A. (Chemical Technology Div./Materials Science and Technology Program, Argonne National Lab., Argonne, IL (US)). pp 185-194 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

The structures of Al/sub 2/F/sub 7//sup -/ and Al/sub 2/Cl/sub 7//sup -/ have been investigated using ab initio molecular orbital theory including the effects of polarization functions in the basis sets. The Al/sub 2/F/sub 7//sup -/ ion is found to have a linear or nearly linear Al-F-Al bridge while Al/sub 2/Cl/sub 7//sup -/ is found to have a bent Al-Cl-Al bridge with a significant barrier to inversion (4 kcal/mol). Structures with two and three halogen atoms in the bridge were also investigated and found to be less stable than the structures with one halogen atom in the bridge.

4005 Photochemistry

45480 Collision-induced intersystem crossing of NH by O_2. Presser, N.; Zhu, Y.F.; Gordon, R.J. (Univ. of Illinois, Chicago (USA)). *Journal of Physical Chemistry;* **91**: No. 16, 4383-4388(1987). Contract AC02-77ER04426.

Fluorescence from NH($A^3\Pi$) was detected when a mixture of HNCO, O_2, and He was excited with a vacuum-UV flash lamp. This emission had a decay of time of up to 1 ms, indicating that the NH($A^3\Pi$) state was generated by long-lived metastable precursors. From a number of photochemical tests the authors deduced that the most likely candidates are NH($b^1\Sigma^+$) + O_2($a^1\Delta$/sub g/), which pool their energy to produce NH($A^3\Pi$) + O_2($X^3\Sigma$/sub g/$^-$).

4006 Radiation Chemistry

45481 (NEI-DK—86) Kinetics and mechanism of elementary chemical processes of importance in combustion. Periodic report 1 for the period 1.4.1986 - 30.9.1986. Spectrokinetic studies of vinyl radicals. Munk, J.; Pagsberg, P.; Ratajczak, E.; Sillesen, A. (Risoe National Lab., Roskilde (Denmark)). Oct 1986. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754475/JAW.

The technique of pulse radiolysis combined with time resolved UV-absorption spectroscopy was employed in spectrokinetic studies of vinyl radicals. Vinyl radicals were produced by the addition of H-atoms to acetylen and by the argon sensitized radiolysis of vinyl chloride or 1.3 butadiene. Transient UV-absorption signals observed in the range of 200-250 nm were assigned to vinyl radicals. For the absorption maximum at 210 nm we have estimated an extinction coefficient of 2000 M/sup -1/cm/sup -1/. The decay of vinyl radicals was studied by monitoring the absorption time profiles at different wave lengths and the observation of a stable product absorption is well accounted for by 1,3 butadiene produced by combination of vinyl radicals. (EG).

45482 (NEI-DK—87) Kinetics and mechanism of elementary chemical processes of importance in combustion. Periodic report 2 for the period October 1986 - April 1987. Spectrokinetics Studies of Vinyl and Propargyl Radicals. Munk, J.; Pagsberg, P.; Ratajczak, E.; Sillesen, A. (Risoe National Lab., Roskilde (Denmark)). Apr 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754476/JAW.

UV-spectra of vinyl and propargyl radicals have been recorded employing the technique of pulse radiolysis combined with time resolved UV-absorption spectroscoppy. The kinetics of vinyl radiocals was studied by monitoring the transient absorption signals in the range of 215-230 nm. In the presence of oxygen we observed the build-up of strong transient absorption signals at 230nm. Based

on analysis of the spectral and kinetic features we have tentatively assigned the new absorption band to the vinyl peroxy radical. Propargyl radicals were produced by the argon sensitized radiolysis of propargyl bromide. In addition to the well-known absorption band at 332 nm we have observed a much stronger band with a maximum at 250 nm. The observed second order decay kinetics is accounted for by the combination reactions 2 C/sub x/H/sub x/ -> products and C/sub 3/H/sub 3/ + Br -> C/sub 3/H/sub 3/ Br. (EG).

45483 **(NEI-DK—88) Kinetics and mechanism of elementary chemical reactions of importance in combustion. Periodic report 3 for the period April-October 1987. Spectrokinetic studies of propargyl radicals. Kinetics of the reaction NH/sub 2/ + NO. UV-spectrum of COOH/HCOO.** Munk, J.; Pagsberg, P.; Ratajczak, E.; Sztuba, B.; Sillesen, A. (Risoe National Lab., Roskilde (Denmark)). Oct 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754477/JAW.

The reaction C/sub 3/H/sub 3/ + O/sub 2/ -> products was studied by pulse radiolysis combined with transient absorption spectrophotometry. A rate constant k = 1.0x10/sup 8/ M/sup -1/ S/sup -1/ was measured at T=298 K and p=1 atm. The Ar-sensitized radiolysis of SF/sub 6/ was employed to obtain a high yield of F-atoms and subsequently NH/sub 2/ or OH via the reactions (1) F + NH/sub 3/ -> HF + NH/sub 2/ and (/sup)/ F ? H/sub 2/O -> HF + OH. Time profiles of NH/sub 2/ and OH were monitored at 597.6 nm and 308.7 nm, respectively. The observed decay rates of NH/sub 2/ in the presence of NO corresponds to an overall rate constant of 1.3 x 10/sup 10/ M/sup -1/S/sup -1/ for the branced reaction NH/sub 2/ + NO -> N/sub 2/ + H/sub 2/O or N/sub 2/H + OH. The relative yield of OH was found to be less than 8% at T 0 298 K and p = 1 atm. Transient absorption signals observed by pulse radiolysis of Ar/SF/sub 6//HCOOH mixtures have been assigned to the carboxyl radicals COOH or the isomeric radical HCOO. (EG).

45484 **(NEI-DK—89) Kinetics and mechanisms of elementary chemical processes of importance in combustion. Periodic report 4 for the period October 1987 - April 1988. Spectrokinetic studies of the reaction OH + CO.** Munk, J.; Pagsberg, P.; Sehested, K.; Sillesen, A. (Risoe National Lab., Roskilde (Denmark)). Apr 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754478/JAW.

The rate and mechanism of the reaction of OH with CO have been investigated by pulse radiolysis combined with transient UV-spectrophotometry. At T = 298 K and p = 1 atm. it appears that the low pressure channel (1a) HO + CO -> H + CO/sub 2/ is much more important than the reaction (1b) HO + CO + M -> HO-C=O + M. At p = 100 - 120 atm wee have observed transient absorption signals in the range of 205 - 240 nm which we tentatively assigned to the collision stabilized HO-C=O adduct. 17 refs. (EG).

45485 **Induction of an ultrafine aerosol by radon radiolysis.** Chu, K.D.; Hopke, P.K.; Knutson, E.O.; Tu, K.W.; Holub, R.F. (Dept. of Nuclear Engineering and Institute for Environmental Studies, Univ. of Illinois, Urbana, IL (US)). pp 365-376 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

Recent advances in measurement methods have allowed for the more complete determination of the aerosol size distribution for particles incorporating Po-218. It has been found that the "unattached" fraction is an ultrafine particle aerosol with a size range of 0.5 to 3 nm. In order to initiate studies on the formation mechanism for these ultrafine particles, a series of experiments were made in the U.S. Bureau of Mines' radon chamber. By introducing SO/sub 2/ into the chamber, particles were produced with an ultrafine size distribution. It has been found that the particle formation mechanism is suppressed by the presence of radical scavengers. These experiments suggest that radiolysis following the decay of Rn-222 gives rise to the observed aerosol and the properties of the resulting aerosol are dependent on the nature and the amount of reactive gas present.

45486 **Development of a mobility analyzer for studying the particle-producing phenomena related to radon progeny.** Kulju, L.M.; Chu, K.D.; Hopke, P.K. (Dept. of Civil Engineering and Institute for Environmental Studies, Univ. of Illinois, Urbana, IL (US)). pp 357-364 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

The determination of the activity size distribution of the ultrafine ions is of particular interest due to their influence on the movement and deposition of Po-218. These ultrafine ions are the result of radiolysis and their rate of formation is a function of radon concentration, the energy associated with the recoil path of Po-218, and the presence of H/sub 2/O vapor and trace gases such as SO/sub 2/. A joint series of experiments utilizing a mobility analyzer, the separate single screen method, and the stacked screen method were conducted to examine the activity size distribution of the ultrafine mode. The results obtained from the mobility analyzer are discussed in this paper.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 44840, 45643, 45801

45487 **(AERE-R—12653) Potentiometric study of the rate of reduction of Pu(IV) by hydroxylamine.** Miles, J.H.; Norwood, K.S. (UKAEA Harwell Lab. Chemistry Div.). Jul 1987. 44p. H.M. Stationery Office, London, price Pound 5.00.

A potentiometric technique has been developed and used to study the reduction of Pu(IV) by hydroxylamine in nitrate media at 25/sup 0/C and 60/sup 0/C. The 25/sup 0/C experiments were carried out at total Pu concentrations between 0.04M and 0.00003M, nitric acid between 1.2M and 0.4M and hydroxylamine between 0.15M and 0.007M. The 60/sup 0/C experiments were carried out under more restricted conditions. A computer program was written to process the experimental results because of the continuous variation in hydroxylamine concentration and acidity which occur during the progress of the reaction. In spite of the wide range of Pu concentrations, the Scott Barney equation is obeyed. Spectrophotometric results obtained are also included. Very approximate calculations suggest that contactors run at 60/sup 0/C will be satisfactory provided a low phase volume ratio (≦ 1) is used.

45488 **(CEGB-TPRD/B—1013/R87) Transfer of volatile species between gaseous and liquid phases with particular reference to inorganic and organic iodine in AGR and Magnox spent fuel transport flasks.** Hewison, R.C. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754275/JAW.

The transfer of volatile species between volumes of water and adjacent gaseous atmospheres is an important step in the assessment of the radiological consequences of hypothetical accidents involving fuel transport flasks. This report develops a general formulation for interfacial transfer of volatile species which is then applied to the case of iodine in both Magnox and AGR fuel transport flasks using a mass transfer approach. (U.K.).

45489 **(INIS-BR—1167) Analysis of utilization on ore of iron-titaniferous containing vanadium from Campo Alegre de Lourdes state of Bahia-Brazil.** Cassa, J.C.S.; Ogasawara, T.; Silva, F.T. da; Cuellar, O.D. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1986. 1p. (CONF-8607372—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703569/JAW.

From 7. Brazilian congress on chemical engineering; Rio de Janeiro, Brazil (1 Jul 1986).

45490 **(JINR—R-6-87-159) Study of thermochromatography of bromides of various elements in comparison with their chlorides.** Kim U Jin; Timokhin, S.N.; Zvara, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 8p. (In Russian). (CONF-8704276—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703409/JAW.

From 11. radiochemical conference; Marianske Lazne, Czechoslovakia (21 Apr 1987).

The thermochromatographic behaviour of chlorides and bromides of /sup 140/La, /sup 160/Tb, /sup 105/Ag, /sup 54/Mn, / sup 137/Cs, /sup 65/Zn, /sup 195/Au, /sup 95/Zr, /sup 175/Hf, / sup 95/Nb ("carrier-free radionuclides) in quartz column was studied. From the experimental data a correlation was observed between the deposition temperature on the column and the enthalpy of sublimation of the chlorides and bromides under study. The enthalpy of adsorption of the halides were also evaluated. 2 refs.; 2 tabs.

45491 **(YJT—88-04) Dissolution mechanism of UO/sub 2/ at various parametric conditions.** Ollila, K. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Reaktorilaboratorio). (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Apr 1988. 56p. NTIS (US Sales Only), PC A04/ MF A01. Order Number DE88754516/JAW.

The aim of this experimental study is to investigate the solubility and dissolution mechanism of uranium dioxide under simulated disposal conditions of spent fuel. Unirradiated UO/sub 2/ is used as a surrogate for spent fuel. Two types of synthetic groundwaters were used in these experiments, on simulating the natural conditions deep in granitic bedrock (synthetic groundwater I) and the other simulating the effects of bentonite on groundwater (synthetic groundwater II). The effect of carbonate concentration was investigated by following dissolution in sodium bicarbonate solution as a function of bicarbonate concentration. Deionized wate was used as a reference water. All the experiments were carried out under both air-saturated, oxidizing and anoxic, reducing conditions. A separate test series under anoxic conditions was initiated in order to study the oxidation state of uranium. The experimental uranium solubilities are compared with the solubilities obtained from theoetical calculations by applying the geochemical code PHREEQ. The theoretical solubility values of uranium under oxidizing conditions calculated by PHREEQE are higher when compared to the corresponding experimental solubility values. The reason for the lower solubility values may be the mechanism of dissolution leading for example either to a situation where low dissolution rate is a limiting factor or to formation of some solid phase of uranium with lower solubility. Formation of a surface layer was observed on the pellet after dissolution in synthetic groundwater II. The theoretical solubility values under educing conditions calculated for uranium by PHREEQE appear to be in good agreement with the experimental solubility values.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 44593, 44687, 44958

45492 (EPRI/EA/EL—5612, pp 4.19-4.20) **Ultrasonic process for the destruction of PCBs in oil and soil.** Sittenfield, M. (Marcus Sittenfield and Associates, Philadelphia, PA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Ultrasonic radiation promotes chemical reactions by means of high energy generated in the cavitation zone created in liquids. In the case of incineration, when the equipment is properly designed and operated, the process has a destruction efficiency of 99.999% of the PCBs fed. However, there are some inherent problems: (1) dioxins can be formed in the combustion process; (2) portable incinerators are difficult to design and operate at peak efficiencies; (3) it is not possible to decontaminate liquids by burning only the PCBs; and (4) if the contaminated material is non-combustible, then fuel costs can become quite high. The ultrasonic process developed by Hazardous Waste Management, Inc. for decontaminating various liquid and solid substrates containing PCBs represents a novel approach to the PCB problem. The process is based on the fact that under extreme conditions of temperatures, such as are obtained in the cavitation zone generated by ultrasonic action, PCBs will react with other chemicals resulting in breaking carbon-to-carbon and carbon-to-chlorine bonds. The HWM process consists of irradiating PCB containing material in the presence of an alkaline material with ultrasonic energy of sufficient intensity to destroy the PCBs. Alkaline substances are added to remove any chlorine or chloride ions and permit the reaction to go to completion.

45493 (EPRI/EA/EL—5612, pp 4.24-4.25) **Plasma-arc destruction of hazardous wastes.** Joseph, M.F.; Barton, T.G.; Vorndran, S.C.; Reed, W.H. Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

The Westinghouse Plasma Systems PYROPLASMA waste-destruction unit destroys liquid organic materials by breaking the molecular structure of chemical wastes and changing hazardous wastes into nonhazardous, potentially useful substances. The highly efficient mobile destruction process is based upon the concept of pyrolyzing waste molecules using a thermal plasma field.

45494 **(NAL-TR—941) Analysis of a turbulent premixed V-flame. Influence of flame-thickening.** Masuya, Goro. (National Aerospace Lab., Chofu, Tokyo (Japan)). Aug 1987. 12p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753878/JAW.

The Bray-Moss-Libby model along with an improved laminar model was applied to a turbulent premixed V-flame to verify the validity of the model and to investigate the influence on the turbulence structure of the flame. Many terms are added to the transport equations to which the flame temperature increases linearly to the downstream direction, in comparison with those of a planar flame with constant thickness. Because of the new terms, a model for the mean reaction rate, which is not necessary for a constant flame, was introduced by converting the model corresponding to the constant thickness flame to a cylindrical coordonate. The caluculated results predicts correctly the qualitative tendency of experimental data of the flame thickening measured by Cheng and agreed well except near the already burned side boundary. The influence increasing the reaction band thickness was studied by calculating the flame of constant thickness. (12 figs, 1 tab, 29 refs)

45495 **(NP—8770336) Analysis of heavy neutral and charged soot particles from rich, premixed hydrocarbon/ oxygen, low-pressure flames.** Wolf, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physikalische Chemie und Chemische Technologie). 7 Apr 1986. 180p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88770336/JAW.

Samples were taken from different flame zones of rich, premixed low-pressure flames of ethine and benzene; the heavy charged soot particles were then separated according to their charge and kinetic energy and were captured on carriers for electron microscopy. The positive, negative and neutral soot fractions were determined by optical density measurements of the soot deposited on the plates. The detection limit was around 7000 to 10000 μ, so that only heavy soot particles were recorded. In ethine flames, 50 to 60% of the soot particles are charged in the peak region, i.e. at about 60 mm from the burner surface. This requires corrections in the values given by Wersborg et al. In benzene flames, no charged particles could be detected by this technique. The soot deposition pattern on glass plates suggests that the particle size is much smaller than in ethine flames. This is consistent with a soot formation mechanism in which the primary particles are formed of reactive PAH with short side chains, whose concentrations are higher in benzene flames than in aliphatic flames.

45496 (NP—8770337) **Combustion processes in methanol-oxygen-nitrogen flames and hydrocarbon-oxygen-nitrogen flames, with particular regard to nitrogen monoxide formation.** Weyrauch, V.W. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physikalische Chemie und Chemische Technologie). 10 Feb 1986. 214p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770337/JAW.

Measurements and model calculations were to establish the different rate of NO formation in methanol flames as compared with hydrocarbon flames. The concentration profiles of the main combustion products, the NO yield, and the flame temperatures were measured. The influence of temperature and mixture composition was established by varying the fresh gas flow rate and the equivalence ratios of the fuel mixtures. Parallel to the experiments, the measured results were compared with model calculations of NO formation in flames. Modelling of NO formation in model flames was found to be impossible. The model calculations yielded much lower values than the measurements. The reaction model is assumed to be insufficient, owing to the fact that it does not consider the 'prompt' NO formation pathway.

45497 (NP—8770338) **Effects of spraying on the evaporation of liquid fuels in turbulent spray flames.** Schneider, M.H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physikalische Chemie und Chemische Technologie). 27 Jan 1986. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770338/JAW.

The dissertation investigates the droplet size in spray flames and the modelling of droplet formation parameter. Two laser-optical methods were chosen for this purpose, i.e. the measurement of the diffraction intensity at angles of 0.2 to 5/sup 0/ and the measurement of the polarisation ratio and intensity of scattered light at an angle of 90/sup 0/. The work comprised the development of the experimental procedure, data acquisition and processing, regression calculations, and the development of the computer programs required for modelling spray evaporation. Using the method of scattered light measurement with high local resolution, the evaporation of the sprayed fuel was recorded in detail by measuring axial and radial droplet size and droplet number density profiles in cold and burning sprays, and the macroscopic flame properties (e.g. light or soot formation) are explained on the basis of the experimental findings. Using a simple model of steady-state single-droplet evaporation followed by infinitely fast evaporation of the fuel vapour, the measured findings were compared with the model calculations. The theoretical and experimental results were found to be in good agreement.

45498 **An integral analysis of the structure and propagation of stretched premixed flames.** Chung, S.H.; Law, C.K. (Dept. of Mechanical Engineering, Seoul National Univ., Seoul (KR)). *Combustion and Flame;* 72: No. 3, 325-336(Jun 1988).

The structure and propagation of stretched premixed flames with preferential diffusion are analyzed using an approximate integral approach which yields algebraic relations for the characteristic scales, overall conservation requirements, and balances and continuity between the various scalar properties and their transport rates. Specific flame configurations studied include the one-dimensional steadily propagating planar flame, the steady curved flame in non-uniform flow, and the outwardly/inwardly propagating spherical flame. Linearized results agree with those obtained from asymptotic analysis assuming small stretch. The present work yields enhanced insight into the dominant and coupled physical processes governing these complex flame phenomena, and demonstrates the utility of the integral analysis in theoretical combustion studies.

45499 **A model and data for freezing temperature lowering of 4 to 7 component molten salt mixtures.** Prengle, H.W. Jr.; Shah, S.P. (Univ. of Houston, Houston, TX (US)). pp 83-92 of Proceedings of the joint international symposium on molten salts. Mamantov, G.; Blander, M.; Hussey, C.; Mamantov, C.; Saboungi, M.L.; Wilkes, J. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710214—).

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Research was conducted to find molten salt mixtures, compatible with alkali metal sulfates, as media for ammonium hydrogen sulfate reactions. Mixtures of mono- and divalent metal sulfates having freezing temperatures of — 550 K were sought, pure sulfates melt at 1000 to 1300 K. Nine divalent metal sulfates with three alkali metal sulfates were used. For interpretation of experimental data a thermodynamic model was developed, the key parameter being the "excess entropy-enthalpy function", positive values of the excess function produce greatest effect. Results gave 4-components 640K; for 5-components 631 K; for 6-components 596 K; and 7-components 593 K.

42 ENGINEERING

REFER ALSO TO CITATION(S) 45116

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 44616, 44617, 44645, 44654, 44699, 44803, 44806, 44809, 44831, 44835, 45283, 45345, 45568, 45603, 45606, 46158

45500 (AD-A—192337/4/XAB) **Electrodynamic driver for the space thermoacoustic refrigerator (STAR). Master's thesis.** Fitzpatrick, M. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1988. 187p. NTIS, PC A09/MF A01.

The objective of the STAR project is to test and space qualify a new continuous-cycle cryogenic refrigeration system for cooling of sensors and electronics which is based upon the newly discovered thermo-acoustic heat-pumping effect. The new refrigerator has no sliding seals, a cycle frequency of about 300 Hz, and uses acoustic resonance to enhance the overall power density and efficiency. This thesis is concerned specifically with the design and testing of the electrodynamic transducer, which is responsible for the electro-acoustic power conversion. A computer model of the driver/resonator system is presented along with the techniques for measurement of the electrical and mechanical parameters used as input for the model. A final driver design (including dimensional drawings) utilizing a modified JBL 2450J neodymium-iron-boron compression driver and associated leak-tight electrical feedthroughs, microphone, accelerometer, pressure gage, pressure housing, and resonator interface is provided.

45501 (AD-A—192430/7/XAB) **Sizing-determination final report. Final contractor report, April 1983-June 1984.** Jackson, L.; Derringer, G.; Steegmann, A.T.; Brletich, R. (Battelle Columbus Labs., OH (USA)). Feb 1988. 375p. NTIS, PC A16/MF A01.

The objective of this effort was to conduct a sizing study that would result in the development of non-objective sizing device(s) for the M17 and the XM40 masks. Sizing parameters were established and measuring devices were fabricated to improve the precision and accuracy of measuring facial characteristics. ILC conducted an in-house test to comparatively examine the methods of sizing determination, and CRDEC conducted a combined anthropometric/protection factor study. Analysis of both sets of data for the aforementioned tests by Battelle, CRDEC, and ILC indicated that the use of facial measurements does not accurately determine the optimum mask size which provides the best mask fit.

45502 (AD-A—192596/5/XAB) **Effect of heat and chemical protective clothing on the ability of a group of female soldiers to sustain performance of military cognitive tasks. Final report.** Fine, B.J. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). Dec 1987. 37p. (USARIEM-T—7/88). NTIS, PC A03/MF A01.

The author previously found that chemical protective clothing seriously degraded the performance of sedentary male soldiers doing sustained mental work in the heat. Here in an identical study, the authors examine the performance of female soldiers in protective clothing. To the author's knowledge, this is the only controlled study of its kind with women. Eighteen female soldiers trained for two weeks on cognitive tasks resembling those performed by fire direction center, forward observer, and communications personnel. Then, they performed the tasks for seven-hour periods on four suc-

cessive days in hot (91 F., 61% RH) and normal (55 F., 35% RH) or (70 F., 35% RH) with and without chemical protective clothing.

45503 **(AD-A—192907/4/XAB) Superconducting electronic-film structures. Annual report, 1 January-31 December 1987.** Braginski, A.I.; Gavaler, J.R.; Talvacchio, J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 24 Jan 1988. 26p. NTIS, PC A03/MF A01.

Bulk samples of the new oxide superconductors were prepared and some of their properties measured. Thin films of yttrium-barium-copper-oxide, completely superconducting below 85K, were prepared by both sputtering and evaporation. The sputtered films on (100) and (110) strontium-titanium-oxide substrates were epitaxial. A correlation between oxygen content in as-deposited films and the formation of non-superconducting surface layers was established. The thickness of these layers was greatly reduced by sputtering in argon and oxygen gas mixtures. The presence of fluorine in the evaporated films was also found effective in minimizing the barium segregation which produces such layers. Zero-resistance gold-contact layers were obtained on Y-Ba-Cu-O-sputtered films which were processed entirely in situ. Tunneling data using a low-temperature tunneling microscope were obtained on both evaporated and sputtered Y-Ba-Cu-O films. A new surface characterization capability based on the analysis of (Low Energy Electron Diffraction) or (Reflection High Energy Electron Diffraction) diffraction spot intensity was developed.

45504 **(AD-A—192908/2/XAB) SIS (superconductor-insulator-superconductor) mixer research. Annual technical report, November 1986-November 1987.** Feldman, M.J. (Virginia Univ., Charlottesville (USA). Dept. of Electrical Engineering). Feb 1988. 12p. (UVA—525658/EE88/102). NTIS, PC A03/MF A01.

Theoretical and experimental research was conducted to elucidate the basic physics behind the properties of superconductor-insulator-superconductor (SIS) tunnel-junction receiving devices. The saturation of the gain of the SIS mixer was measured using both monochromatic and thermal signals, and these experiments dramatically verified the theoretical expression derived in the previous report period. A study of the role of the image termination for SIS mixer behavior found that the nonlinear quantum reactance results in an effective time delay at the input port of the mixer. Many aspects of the operation of SIS mixers at submillimeter wavelengths were clarified, including a discussion of the potential of the new oxide superconductors for this field. The goal of the realization of high-quality niobium nitride edge junctions was advanced by optimizing the edge profile and by improving the insulating barrier.

45505 **(BFR-R—19-1987) Long-term properties of oxygen-impermeable plastic pipes and insulation for secondary district heating.** Ifwarson, M. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 120p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88753674/JAW.

This report describes the results from long-term evaluation of oxygen-impermeable plastic piping and insulating materials for secondary district heating system. The report also makes preliminary recommendations for type testing of oxygen-impermeable plastic piping and thermal insulation.

45506 **(INIS-mf—11238) Operation experience and analysis of the efficiency of K-220-44 turbine with a ball cleaning system in the condensers.** Stefanov, G.; Georgiev, S.; Zlatev, Zl.; Deliganev, S.; Petrova, J. (Kombinat Atomna Energetika, Kozloduj (Bulgaria)). 1986. 5p. (CONF-8609439—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703581/JAW.

From National conference on nuclear energy problems; Varna, Bulgaria (25 Sep 1986).

A ball cleaning installation, manufactured by GEA, FRG is in operation since 1983 at Kozloduj in the condensers of turbine no. 8, Unit 4. In order to evaluate the effectiveness of the system, the vacuum in the condencers of turbines 8 and 7 (at the same unit) are compared. It is found that the vacuum in the condensers with ball cleaning is higher by 2.28% in the average, resulting in 8.80 MW increase in the turbine power output. This result is very satisfactory and installing of the Bulgarian made ball cleaning systems for all the plant units will start by the end of 1987.

45507 **(JINR—13-87-566) Autocompensation device for ultralow temperature measurements.** Gorodishenin, N.L.; Evdokimov, V.A.; Katushenok, S.S.; Kiselev, Yu.F.; Chernikov, A.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702900/JAW.

Submitted to the journal Cryogenics.

A noise-protected meter for ultralow temperatures with a thermoresistor symmetrically connected to a low-noise preamplifier at the input and with a driftless digital lock-in detector at the output is described. The negative feedback circuit includes a multiplier of the analogue signal and the digital code. This principle of circuit construction is found to allow a considerable reduction of experimental errors under actual cryogenic conditions. The resistance range being 0.02-200 kΩ, the operating model of the device provides +- 0.5% accuracy of heart supply below 5x10/sup -14/ W. 4 refs.; 4 figs.

45508 **(KFK—4316) International Advanced Robotics Programme. First workshop on manipulators, sensors and steps towards mobility. Proceedings.** Martin, T. (ed.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekttraegerschaft Fertigungstechnik). Sep 1987. 313p. (CONF-8705305—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754181/JAW.

From 1. workshop on manipulators, sensors and steps towards mobility; Karlsruhe, F.R. Germany (11 May 1987).

This Workshop was held within the framework of the international collaboration in the area of advanced robotics, formerly initiated by the Economic Summit, called the International Advanced Robotics Programme (IARP). It was hosted by the Nuclear Research Center Karlsruhe on May 11-13, 1987. Ninety scientists of eight countries presented and discussed 32 R+D projects. The Proceedings contain full papers of most contributions (and summaries of the remaining ones) and summary reports on all of the eight sessions. The material presented reflects well the present endeavor to integrate advanced robotics and teleoperation techniques for difficult applications in harsh, demanding or dangerous conditions or environment.

45509 (KFK—4316, pp 13-26) **Advanced robotics R+D at KfK.** Rininsland, H.; Smidt, D.; Trauboth, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik). Sep 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754181/JAW. (CONF-8705305—).

From 1. workshop on manipulators, sensors and steps towards mobility; Karlsruhe, F.R. Germany (11 May 1987).

Particular considerations for teleoperated and very long reach robotic systems are given. Robotic systems involving long reach referred to, include the TFTR maintenance boom developed for the Princeton fusion reactor and future automated cranes and bridge inspection equipment. A project to develop such long reach booms currently involves Putzmeister and the NRC, who will be responsible for developing the collision avoidance algorithms as part of a 'computer aided telemanipulation' approach. Problems encountered with operating equipment of this kind remotely were addressed during the recent Chernobyl disaster at which a range of equipment developed by Putzmeister was applied to combat the disaster.

45510 (KFK—4316, pp 69-84) **Technical characteristics of the electric master-slave manipulators.** Koehler, W.; Salaske, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Sep 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754181/JAW. (CONF-8705305—).

From 1. workshop on manipulators, sensors and steps towards mobility; Karlsruhe, F.R. Germany (11 May 1987).

The paper gives an overview of the current state of the art of electric master-slave manipulators. The paper shows the great need to think and realize a suitable man-machine interface acceptable to the operator.

45511 (KFK—4316, pp 97-99) **Automatic and manual operation modes of the TFTR maintenance manipulator.** Boehme, G.; Gumb, L.; Lotz, E.; Mueller, G.; Selig, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Sep 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754181/JAW. (CONF-8705305—).

From 1. workshop on manipulators, sensors and steps towards mobility; Karlsruhe, F.R. Germany (11 May 1987).

The remote in-vessel operations scheduled to maintain the TFTR at Princeton, NJ, USA, comprise inspection, calibration, cleaning and protective tile replacement. The environmental conditions inside the torus vessel are ultra high vacuum, moderate γ-radiation and 150/sup 0/C temperature of the vessel structure. The Princeton Plasma Physics Laboratory (PPPL) and KfK are jointly developing a maintenance manipulator (MM) which can perform these tasks.

45512 (KFK—4316, pp 153-154) **Locomotive vacuum suction disks for wall robots used at nuclear power plants.** Sato, K. (JGC Corp., Yokohama (Japan)). Sep 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754181/JAW. (CONF-8705305—).

From 1. workshop on manipulators, sensors and steps towards mobility; Karlsruhe, F.R. Germany (11 May 1987).

A project to develop a wall climbing robot to be used in nuclear power plants is presented. Its envisaged tasks are inspection and decontamination works while travelling on the walls of containment vessels and other plant equipment. The robot can retain itself on a wall with its two vacuum suction disks. It moves unto walls from floors and strides over wall obstacles by moving its two jointed members. Demonstration of a prototype robot is being planned for 1990. The robot is supplied via cable. A failsafe concept against air pressure drop is not being considered.

45513 (ND-R—1390(S)) **Proposed design for the new SNL air-transporter.** Hardy, A.R.; Kennedy, S.T.; Haberlin, M.M. (UKAEA Northern Research Labs., Springfields). (UKAEA Northern Research Labs., Risley). Jan 1988. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754289/JAW.

The design of a prototype air-transporter suitable for remote operation in a size reduction facility is discussed. The first section describes the design concept selected for the transporter, that of a series of modular units within a simple rigid framework and the detailed design of the individual modules. The design has the following features: electrical drive units, self contained air-skates, electrical logic circuit placed outside the working area, pneumatic and electrical umbilicals and provision for specific items of ancilliary equipment. The second section describes the detailed evaluation of various cable handling systems for the umbilicals from the control console outside the facility to the transporter. It has been established that the optimum system is a single rail festoon complete with transporter mounted pivoting arm.

45514 (NEI-NO—44, pp 33-58) **Riser arrangements and subsea production systems for a gas tension leg platform. .** Fjell, K.H.; Poore, A.W. (Statoil, Stavanger (Norway); Brown and Root UK Ltd., London (GB)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

Tension Leg Platforms (TLP) became a reality with the installation of the Conoco Hutton TLP. Many oil companies now consider TLPs as a viable development option particularly for deeper water. One critical area of TLP design is the riser system and riser related subsea equipment. This paper outlines the work undertaken to establish a viable riser system components, riser analysis and the installation of control lines inside risers. 14 drawings, 3 tables.

45515 (NEI-NO—44, pp 89-111) **Research into new methods for detection and sizing of defects in Subsea steel constructions.** Newton, K.; Wein, A.P.; Hawker, B.M. (Harwell Laboratory, UKAEA, Oxfordshire (GB)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

While several methods are available for the detection of defects during fabrication or in-service inspection, underwater detection of defects is mainly performed by divers using visual inspection or MPI. There are fewer methods for assessment of defect depth (e.g. A.C. Potential Drop and ultrasonics) and conventional ultrasonic methods are based on signal amplitudes which can lead to inaccurate sizing. The need to improve the reliability and cost of underwater crack detection and sizing has stimulated a wide range of research and development work. This paper briefly describes R and D programmes being carried out for the offshore industry by one particular multi-client sponsored project at Harwell. These include the development of a new ultrasonic defect sizing tehcnique, improvement of eddy current chack detection techniques, and an investigation into the mechanisms by which fatigue cracks can be transparent to some inspection techniques. The first programme, development of the ultrasonic Time-of-Flight Diffraction (TOFD) technique for use by divers to size defects in sub-sea welds, has recently been completed and is described in detail. The results of laboratory validation and diver trials of a complete prototype system both in a test tank and in open seawater are presented. Work required to enable early use of the technique in the North sea is discussed. 7 drawings, 1 table.

45516 (PB—88-866033/XAB) **Chemical and biological warfare: protection, decontamination, and disposal. January 1979-June 1988 (citations from the NTIS data base). Report for January 1979-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 208p. NTIS PC N01/MF N01.

Supersedes PB—87-863635.

This bibliography contains citations concerning the means to defend against chemical and biological agents used in military operations, and to eliminate the effects of such agents on personnel, equipment, and grounds. Protection is accomplished through protective clothing and masks, and in buildings and shelters through filtration. Elimination of effects includes decontamination and removal of the agents from clothing, equipment, buildings, grounds, and water, using chemical deactivation, incineration, and controlled disposal of material in injection wells and ocean dumping. Other published searches in this series covers chemical warfare detection, defoliants, general studies, biochemistry and therapy, and biology, chemistry and toxicology associated with chemical-warfare agents. (This updated bibliography contains 338 citations, 20 of which are new entries to the previous edition.)

45517 (SAND—87-2710C) **Linear-quadratic-regulator pointing control system design for a high-altitude balloon payload.** White, J.E.; Etter, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 42p. (CONF-880818—1-Draft). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004801/JAW.

From Guidance, navigation and control conference; Minneapolis, MN, USA (15 Aug 1988).

A pointing control system design for the science package of a NASA high-altitude research balloon is described. The balloon assembly consists of a single helium balloon connected to a payload recovery parachute, payload gondola, and ballast hopper. Pointing of the scientific payload is accomplished via an arrangement of drive motors and a flywheel. Linear quadratic regulator (LQR) synthesis techniques are employed to produce the azimuth and elevation controller designs. The use of LQR synthesis is motivated by the azimuthal dynamic coupling encountered between the balloon and gondola. Two control devices are employed in azimuth, one of which is a decoupler motor and the other a flywheel. The

decoupler motor is intended to isolate the gondola from the balloon such that the flywheel can be accelerated or decelerated about a steady-state angular velocity to provide precise azimuthal pointing. The multiple-input/multiple-output nature of the azimuth pointing problem is best handled in a matrix synthesis procedure such as LQR. The controller design methodology is explained, and a combination of time responses and singular value analyses are used to analytically evaluate the performance of the control system. 11 refs., 17 figs.

45518 **(SAND—87-2872C) Microwave RF coupling response through adjacent cavities.** Toth, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8805132—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012430/JAW.

From 4. national high power microwave conference; Monterey, CA, USA (9 May 1988).

The segmentation of the interior volume of a modern weapon system into functionally associated compartments is viewed as a series of multiple connected microwave resonators. It is known that the magnitude of the microwave coupling phenomena is affected by the presence of apertures, conductors, and dielectrics and that each of these factors may interact to exhibit a complex frequency dependence. A large resonator test object was subdivided with adjustable bulkheads which included openings and monopoles connecting adjoining volumes. Microwave signal injection was by either an external monopole receiving antenna or by seam leakage into the test object interior. 5 figs.

45519 **(SAND—88-0617) Detailed analysis of the structural consequences of railgun augumentation.** Wellman, G.W.; Schuler, K.W. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013800/JAW.

The advantage of augmenting a plasma railgun is to provide the same driving force on the projectile as in an unaugmented railgun at a lower plasma arc current, thus producing less erosion and barrel damage. However, there are structural consequences to railgun augmentation which must be overcome before the advantages of lower plasma arc currents can be realized. To investigate these consequences, a bolted V-block supporting structure is considered with two cores; unaugmented (a single pair of conducting rails), and augmented (conducting rails augmented by a second tandem set of conductors). For each core, a two-dimensional dynamic finite element structural analysis is performed. The loadings, applied sequentially, consist of the static bolt preload, the plasma pressure behind the projectile, and the magnetic pressure induced by currents flowing in the rails or augmenting conductors. The magnetic pressure induced by currents flowing in the rails or augmenting conductors. A maximum rail current is found for which the unaugmented railgun can be fired without permanent deformation of the gun bore, thus allowing repeated firings. For the augmented railgun, at the same projectile acceleration, large permanent deformations are shown. 7 refs., 41 figs., 2 tabs.

45520 **(UCRL—98549) Human engineering considerations in designing a computerized controlled access security system.** Moore, J.W.; Banks, W.W. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 5p. (CONF-880633—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012438/JAW.

From 4. international conference on human factors and power plants; Monterey, CA, USA (5 Jun 1988).

This paper describe a human engineering effort in the design of a major security system upgrade at Lawrence Livermore National Laboratory. This upgrade was to be accomplished by replacing obsolete and difficult-to-man (i.e., multiple operator task actions required) security equipment and systems with a new, automated, computer-based access control system. The initial task was to assist the electronic and mechanical engineering staff in designing a computerized security access system to functionally and ergonomically accommodate 100% of the Laboratory user population. The new computerized access system was intended to control entry into sensitive exclusion areas by requiring personnel to use an entry booth-based system and/or a remote access control panel system. The primary user interface with the system was through a control panel containing a magnetic card reader, function buttons, LCD display, and push-button keypad. In addition, retinal eye scanner was used for enhanced user identification in a few sensitive exclusion areas.

45521 **(UCRL—98906) Aboveground test results for mirrors hardened using the Livermore SOC [Survivability of Coatings] concept.** Edwards, D.F.; Wirtenson, G.R.; Rhoades, C.E. Jr.; Saito, T.T.; Gillespie, C.H.; Hsieh, E.J.; Syn, C.K.; White, R.H. (Lawrence Livermore National Lab., CA (USA)). 8 Jun 1988. Contract W-7405-ENG-48. 33p. (CONF-8710254—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012432/JAW.

From 19. annual symposium on optical materials for high power lasers; Boulder, CO, USA (26 Oct 1987).

We reported at the two previous meetings that optical coatings could be significantly hardened to soft x-rays (SXR) using the Livermore Survivability of Coatings (L-SOC) concept for enhanced energy sharing. Reported here are the results for a number of different optical designs tested aboveground in 1986 using the Blackjack 5 SXR radiation facility, a Defense Nuclear Agency facility operated by Maxwell Laboratories, Inc. 16 refs., 14 figs., 4 tabs.

45522 **Rotary recuperative magnetic heat pump.** Kirol, L.D.; Dacus, M.W. (EG & G Idaho, Inc., Idaho Falls (USA)). pp 757-765 of Advances in cryogenic engineering. Volume 33. Fast, R.W. (ed.). New York, NY; Plenum Press (1988). (CONF-8706125—).

From Cryogenic engineering conference; St. Charles, IL, USA (14 Jun 1987).

A bench scale heat pump is described which relies on parallel flow paths for achieving recuperator flow. The primary flow leg allows heat transfer between external load and sink and magnetic working material while parallel flow accomplishes recuperation. The bench scale test is intended to demonstrate feasibility of the concept and to verify that all significant loss mechanisms are identified and treated properly in performance models. It is not a scaled down version of a practical heat pump. Working material is gadolinium foil. Magnetic fields are created by neodymium-iron-boron permanent magnets with an air gap field of about 0.9 T.

4203 Lasers

REFER ALSO TO CITATION(S) 45426, 45551, 46098, 46106

45523 **(AD-A—192301/0/XAB) Development of a high-efficiency Q-switched glass laser via sol-gel processing. Final technical report, 15 August 1987-14 February 1988.** Moreshead, W.V. (Geltech, Inc., Alachua, FL (USA)). 14 Feb 1988. 26p. NTIS, PC A03/MF A01.

The sol-gel process is a logical choice for silica-based laser glasses, since it requires lower processing temperatures than traditional melt-glass techniques, and allows good control of purity. This report describes attempts to prepare silica glasses containing neodymium or neodymium and erbium using sol-gel technology. A description of two different doping procedures is given, along with results. The materials produced were characterized and the spectral, thermal, and physical properties are reported. Fluorescence spectra and fluorescence lifetimes are given for three different materials prepared.

45524 **(AD-A—192352/3/XAB) Rare gas halide (RGH) kinetics. Final report.** Kimura, W.D. (Spectra Technology, Inc., Bellevue, WA (USA)). Feb 1988. 153p. (C—11-333). NTIS, PC A08/MF A01.

As a result of the measurements performed during this program and the refinements made to the computer model, understanding of xenon chloride (XeCl) kinetics has increased dramatically. Qualitatively, one might state that understanding of XeCl is now comparable to the other major excimers. Much of the mystery associated with the XeCl kinetics has been lifted. For example, significant vibrational excitation of HCl appears to be occurring as indirectly indicated by the behavior of the electron density. The exact character of the electron energy distribution and its affect on the kinetics is now better understood. The distribution is not entirely

Maxwellian, as was generally assumed by models before this work. Instead, only the low energy distribution (the distribution below the ionization energy of xenon) is Maxwellian; the high-energy distribution is non-Maxwellian. Ultimately, the interest is in improving the performance of XeCl lasers, in particular, scaling them to longer pulse lengths. As mentioned earlier, control of halogen depletion is crucial for achieving long pulse lengths.

45525 **(AD-A—192514/8/XAB) Laser-spectroscopy investigations of materials for solid-state-laser systems. Final report, 16 January 1985-15 January 1988.** Powell, R.C. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). Feb 1988. 155p. NTIS, PC A08/MF A01.

Some of the results of major importance from this work are: (1) development of a method for producing laser-induced grating optical devices in glasses; (2) elucidation of the effects of Mg on inhibiting the photorefractive response of lithium niobate; (3) demonstration of tunable single-pass gain from a closed-shell ion in the visible spectral region; (4) demonstration of the decrease in fluorescence quenching in fiber crystals; (5) demonstration of the effects of thermal annealing on the infrared absorption and visible emission in Ti-sapphire laser crystals; and (6) measurement of the pump band to metastable-state relaxation rate in alexandrite laser crystals.

45526 **(AD-A—192555/1/XAB) Monolithic two-dimensional diode laser arrays.** Walpole, J.N.; Liau, Z.L.; Diadiuk, V. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1987. 8p. (MS—7444). NTIS, PC A02/MF A01.

Pub. in. SPIE, V783-Laser Radar II, 42-48(1987).

Two-dimensional diode laser arrays are being developed for near-term application as efficient incoherent high-power pump sources for solid-state lasers and for uses in the long term as coherent primary sources. A technique for fabricating such arrays was demonstrated that makes use of small deflecting mirrors integrated with diode laser elements formed on a semiconductor wafer surface by lithographic techniques. Monolithic arrays of over 100 elements were fabricated with good uniformity and a power density over 40 w/sq.cm of wafer area.

45527 **(AD-A—192844/9/XAB) Plasma ultraviolet source for short-wavelength lasers. Final report, 15 January 1986-29 February 1988.** Han, K.S. (Hampton Univ., VA (USA). Dept. of Physics). 15 Apr 1988. 31p. NTIS, PC A03/MF A01.

A dense plasma focus (DPF) device was evaluated for the feasibility of blue-green and near-ultraviolet laser pumping. As the result of optimizing the operating conditions of DPF and laser system, the maximum untuned laser output exceeded 4.0 mJ corresponding to the energy density 8.3 J/liter which is much higher than the typical flashlamp dye laser. The spectral irradiance of DPF at the absorption bands for LD390 and LD490 were 5.5 W/sq cm-nm, 0.3 W.sq cm-nm, respectively. Due to the lower pump power of DPF at 355 nm than the threshold of LD390, the laser pumping of LD390 dye was not achieved. A hard-core flashlamp (HCF) which has a coaxial geometry and array of inverse pinches was also evaluated for blue-green and near uv laser excitation. The short pulse (>0.5us) surface discharges were produced across the core insulator of alumina. The spectral irradiance of the HCF depends on argon fill-gas pressure and the core insulating material. The maximum radiative output of the HCF lie in the region of 340-400 nm (absorption band of LD490). A LD490 dye laser pumped by a HCF prototype device had an output of 0.9 mJ with a pulse of 0.5 microsec (full width at half maximum).

45528 **(PB—88-865803/XAB) Acousto-optical laser modulators and deflectors. January 1970-May 1988 (Citations from the NTIS data base). Report for January 1970-May 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 174p. NTIS PC N01/MF N01.

Supersedes PB—87-851010.

This bibliography contains citations concerning acousto-optic equipment used in laser-beam modulation, filtering, scanning, deflection, switching, and tuning. These acousto-optical devices are used in imaging, fiber optics, optical communications, optical radar, and measuring instruments. (This updated bibliography contains 275 citations, 22 of which are new entries to the previous edition.)

45529 **Experimental demonstration of a diode laser-excited optical filter in atomic Rb vapor.** Chung, Y.C.; Shay, T.M. (Dept. of Electrical Engineering, Utah State Univ., Logan, UT (US)). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **24**: No. 5, 709-711(May 1988).

The authors report the first demonstration of a narrow bandwidth optical filter using diode laser-pumped atomic Rb vapor. Excellent rejection of off-resonant laser photons has been achieved. The measured detection bandwidth was 1.18 GHz at the Rb cell temperature of 150°C, which shows a good agreement with the calculated detection bandwidth of 1.02 GHz.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 44669, 44683, 44687, 44872, 44982, 45047, 45048, 45049, 45053, 45758, 45775, 46131

45530 **(CONF-880858—1) Friction reduction and heat transfer enhancement in turbulent pipe flow of non-Newtonian liquid-solid mixtures.** Choi, U.S.; Liu, K.V. (Argonne National Lab., IL (USA)). Feb 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010018/JAW.

From International symposium on heat transfer enhancement and energy conservation (ISHTEEC); Guangzhou, China (2 Aug 1988).

Argonne National Laboratory (ANL) has identified two concepts for developing advanced energy transmission fluids for thermal systems, in particular district heating and cooling systems. A test series was conducted at ANL to prove these concepts. This paper presents experimental results and discusses the degradation behavior of linear polymer additives and the flow and heat transfer characteristics of non-melting slurry flows. The test results furnished strong evidence that the use of friction reducing additives and slurries can yield improved thermal-hydraulic performance of thermal systems. 5 refs., 5 figs.

45531 **(DFVLR-FB—88-09) Numerical simulation and stability analysis of the absolutely and convectively unstable wake.** Hannemann, K. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). 1988. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754146/JAW.

The wake behind a flat plate, held parallel to the free-stream, is simulated numerically using a finite difference Galerkin Method for the solution of the time-dependent, incompressible Navier-Stokes equations. Here, the temporal amplification process of perturbations at supercritical Reynolds numbers, leading finally to the saturation state, is of major interest. The Orr-Sommerfeld stability analysis of the quasi-steady state, occurring during the wake development, reveals that the flow can be divided into a locally absolutely unstable and a locally convectively unstable region. The influence of these stability properties on the wake, as well as their changes with Reynolds number and base bleed, is discussed based on the numerical simulation and the linear, local stability analysis. (orig.) With 59 figs., 2 tabs., 112 refs.

45532 **(DOE/PC/80511—T13) Hydrodynamics, mixing, and segregation in gas fluidized beds: Technical progress report, 22 October 1987 to 21 January 1988.** Chen, M.M.; Chao, B.T. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1988. Contract FG22-85PC80511. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012656/JAW.

This progress report covers the work performed during the period 22 October 1987 through 21 January 1988. Efforts have been focused on experimental measurements of bed fluctuation frequencies using the swarm particle tracking technique and on the continuing theoretical analysis of the gas-mediated heat transfer to immersed surfaces due to particle impact. 3 refs., 5 figs.

45533 **(ENEA-RT-TERM—85-6) Computation method for mass flowrate predictions in critical flows of initially subcooled liquid in long channels.** Celata, G.P.; D'Annibale, F.; Farello, G.E.; Cumo, M. (ENEA, Rome (Italy)). 1985. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702850/JAW.

It is suggested a fast and accurate computation method for the prediction of mass flowrate in critical flows initially subcooled liquid from "long" discharge channels (high LID values). Starting from a previous very simple correlation proposed by the authors, further improvements in the model enable to widen the method reliability up to initial saturation conditions. A comparison of computed values with 145 experimental data regarding several investigations carried out at the Heat Transfer Laboratory (TERM/ISP, ENEA Casaccia) shows an excellent agreement. The computed data shifting from experimental ones is within +-10% for almost all data, with a slight increase towards low inlet subcoolings. The average error, for all the considered data, is 4,6%.

45534 **(INIS-SU—22) Boiling heat transfer in a flat slot between heating surface and perforated plate.** Kirichenko, Yu.A.; Rusanov, K.V.; Tyurina, E.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst. Nizkikh Temperatur). 1987. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702882/JAW.

Preprint-33-87.

The results are presented of the experimental study of heat transfer and crisis at nitrogen boiling in a flat gap between the horizontal heating surface and perforated plate. The gap width is 1.0 to 5.6 mm, diameter of holes is 1.0 to 2.0 mm, their spacing being 3.0 to 12.0 mm. The geometrical parameters dependence of the heat transfer coefficient and crisis characteristics is invesigated, the experimental data are compared with the results reported by other authors and calculations by some well-known formulas. 12 refs.; 3 figs.; 4 tabs.

45535 **(NP—8770285) Digital image processing in hydrological flow experiments.** Haenscheid, P. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bauingenieur- und Vermessungswesen). 6 Jan 1987. 241p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88770285/JAW.

The dissertation addresses engineers in the fields of hydrological engineering and water management. The theoretical part explains the generation, structure, and information content of digital images prior to developing and describing image processing techniques. It is shown how to integrate image processing units in the process data processing system of experimental set-ups, and an exemplary facility is set up. Another efficient image processing system also described was used for two case studies presented in the dissertation. (HAG).

45536 **(NP—8770316) Experimental studies on heavy-duty axial blowers with small hub ratio.** Brodersen, S. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 18 Dec 1986. 204p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770316/JAW.

The author reports experimental studies on heavy-duty axial blowers. The performance and limiting performance of heavy-duty blades with a small hub ratio are discussed. The results are compared with the results of earlier investigations. (HAG).

45537 **(NP—8770326) Heat transfer measurements on smooth and finned tubes in a standard apparatus for boiling experiments.** Fath, W. (Paderborn Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 10 - Maschinentechnik 1). 28 Jul 1986. 116p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770326/JAW.

The use of Rankine cycles with refrigerants or other organic working fluids for waste heat recovery has been a matter of discussion lately. The evaporating pressure is higher in these systems than in conventional application of finned tubes, so the problems of heat transfer in nucleate boiling on finned tubes are investigated here. Measurements were made on smooth and finned tubes and on surface-treated smooth and finned tubes. Refrigerant R-22 was used for the experiments; the measurements cover a wide range of pressures. (HAG).

45538 **(NP—8770341) Modelling of intake duct swirl flow in 4-stroke reciprocating piston engines on the basis of stationary flow experiments.** Frank, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 12 Dec 1985. 220p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770341/JAW.

Mixing and combustion in reciprocating piston engines are influenced significantly by the movement of the charge inside the combustion chamber. The swirl flow inside the cylinder in the intake phase, especially in direct-injection diesel processes, is an important prerequisite of the mixing process. The author therefore analyzed the available methods of swirl flow measurement for steady flow conditions, using theoretical calculations and suitable experiments. Methods of inducing rotation of the charge inside the cylinder were investigated. Measurements were made on cylinder heads and model ducts in order to get a picture of the present, and conceivable future, state of the art. The influence of the swirl generating method on the vector fields of the flow velocities and on the flow turbulence rates inside cylinders in steady flow conditions was determined by hot-wire anemometry. (HWJ).

45539 **(SAND—87-2052C) A general analysis for obtaining the viscosity function from viscometric measurements: A case study for the helical screw rheometer.** Kraynik, A.M.; Romero, L.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-880827—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006271/JAW.

From 10. international congress on rheology; Sydney, Australia (14 Aug 1988).

The concept of viscometric flow is a cornerstone of rheology. The deformation history of a fluid element in such flows is essentially equivalent to steady simple shearing flow. Three material functions that depend upon shear rate γ -- the shear stress {tau}, first normal stress difference N_1, and second normal stress difference N_2 -- completely determine the extra stress and velocity fields for this special class of fluid motions. It is central to rheometry that material functions for fluids with quite general flow behavior can be measured only in a viscometric flow. In the following, we restrict our discussions to the most widely recognized and "most easily measured" flow property, the viscosity function, which is given by $\mu(\{\dot{}\}\gamma) = \{tau\}(\{\dot{}\}\gamma)/\{\dot{}\}\gamma$. 7 refs., 2 figs.

45540 **An evaluation of a translator for finite element data to resistor/capacitor data for the heat diffusion equation.** Manteufel, R.D.; Klein, D.E.; Yoshimura, H.R. (Sandia National Labs., Albuquerque, NM (US)). pp 67-75 of Numerical methods in heat transfer. Emery, A.F.; Douglass, R.W. New York, NY; American Society of Mechanical Engineers (1988). (CONF-871234—).

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

This paper evaluates a translator for finite element data to resistor/capacitor data (FEM/RC) for the numerical solution of heat diffusion problems. The translator involves the derivation of thermal resistors and capacitors, implicit in the heat balance formulation of the finite difference method. It uses a finite element mesh, which consists of nodes and elements and is implicit in the Galerkin finite element method (GFEM). This hybrid translation method, FEM/RC, has been incorporated in Q/TRAN, a new thermal analysis computer code. This evaluation compares Q/TRAN, HEATING-6, and a research code employing GFEM on a purely mathematical, highly nonlinear steady-state conduction benchmark problem. The evaluation concludes that the FEM/RC technique has numerical characteristics that are consistent with comparable schemes for the benchmark problem. FEM/RC also accurately translates skewed meshes. Because FEM/RC generates resistors and capacitors, it appears to offer a more efficient method than the classical GFEM.

45541 **Numerical computation of turbulent free-shear flows using a block-tridiagonal solver for a staggered grid system.** Chen, J.Y.; Kollmann, W.; Dibble, R.W. (Combustion Research Facility, Sandia National Labs., Livermore, CA (US)). pp 1833-1838 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

A Fortran computer program has been developed for solving highly-coupled parabolic partial differential equations. The capability of this program is demonstrated by the stable solutions obtained for five types of free-shear turbulent flows with sophisticated turbulence models. Although the current scheme is applied in obtaining solutions of modeled transport equations for turbulent free-shear flows, the scheme can be easily extended to studying other parabolic systems.

4205 Materials Testing

REFER ALSO TO CITATION(S) 45413, 45639

45542 **(INIS-BR—1110) Automating the radiographic NDT process.** Aman, J.K. (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA)). 1986. 9p. (CONF-8609282—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703211/JAW.

From 1. non destructive testing congress for Latin America and Caribbean; Sao Paulo, Brazil (21 Sep 1986).

Automation, the removal of the human element in inspection, has not been generally applied to film radiographic NDT. The justication for automating is not only productivity but also reliability of results. Film remains in the automated system of the future because of its extremely high image content, approximately 8 x 10/ sup 9/ bits per 14 x 17. The equivalent to 2200 computer floppy discs. Parts handling systems and robotics applied for manufacturing and some NDT modalities, should now be applied to film radiographic NDT systems. Automatic film handling can be achieved with the daylight NDT film handling system. Automatic film processing is becoming the standard in industry and can be coupled to the daylight system. Robots offer the opportunity to automate fully the exposure step. Finally, computer aided interpretation appears on the horizon. A unit which laser scans a 14 x 17 (inch) film in 6 - 8 seconds can digitize film information for further manipulation and possible automatic interrogations (computer aided interpretation). The system called FDRS (for Film Digital Radiography System) is moving toward 50 micron (*approx* 16 lines/mm) resolution. This is believed to meet the need of the majority of image content needs. We expect the automated system to appear first in parts (modules) as certain operations are automated. The future will see it all come together in an automated film radiographic NDT system

45543 **(INIS-BR—1154) Utilization of gamagraphy in shielded substation.** Franca, W.J.; Pereira, M.J. (FURNAS, Rio de Janeiro (Brazil)). 1987. 13p. (CONF-8712100—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703557/JAW.

From 4. Iberian-American congress on maintenance and 2 Brazilian congress on maintenance; Rio de Janeiro, Brazil (7 Dec 1987).

The radiographic inspection using gamma rays applied to the bars/ insulating cones conenctions in SF6 gas-insulated transmission lines to idetify the bars which its lenghts could cause a failure, without disassembling, is presented. Using gamma rays radiography it was possible to correct the lenght of the bars found out the permissible tolerances with substantial reduction of the servicing time and consequently increase of the substation reliability.

45544 **(INIS-BR—1158) Some applications of industrial neutrongraphy.** Joode, A.S.; Mury, A.G.O.S. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 17p. (CONF-8708271—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703561/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

The techniques used and main applications of neutrongraphy as non destructive inspection are presented. The advantages of this technique in relation to radiography and gamagraphy for using in industries are shown. (E.G.).

45545 **(INIS-BR—1161) Inspection of components by X ray in real time in automobile industry.** Demandt, K. (Andrex NDT Systems A/S, (Denmark)). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 14p. (CONF-8708271—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703563/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

Besides a brief introduction to the state of the art of automobile components inspection by radiography in real time, some examples are discussed. New developments and a possible application for automobile components inspection by x-radiation are discussed. (E.G.).

45546 **(INIS-BR—1163) Coke detection in furnaces tubes by radiographic examination.** Santos, I.S. dos. (PETROBRAS, Rio de Janeiro (Brazil)). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 12p. (CONF-8708271—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703565/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

The coke detection technique by radiographic examinations allows to quantify the coke in furnace coils of Petroleum refineries and petrochemical industries. The paper describes how was determined the radiographic parameters, the wall apparent thickness calculation, the distance source-film, the position of the source and films, the chosen of films and the calculation of exposure time, aiming to obtain high producticity and good quality image. This technique is being used and improved for more than two years with good results. (E.G.).

45547 **(LA-UR—88-1229) Laboratory investigations of low earth orbit environmental effects on spacecraft.** Cross, J.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880943—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009135/JAW.

From Uranium and electricity: the complete nuclear fuel cycle; Saskatoon, Canada (18 Sep 1988).

Operations in low earth orbit (100-500 km) must take into consideration the highly oxidative character of the environment. Partial pressures in the range of 10^{-6}-10^{-7} torr of atomic oxygen are present which produces extensive oxidation of materials facing the direction of travel (ram direction). The ram oxidation is most severe not only because of the high flux (10^{15} O-atoms/s-cm^2) caused by the orbital velocity of the spacecraft but also because of the high collision energy of oxygen atoms with the ram surfaces (translational energy equivalent to ~60,000K). Ground based simulation of these conditions has been accomplished using a CW laser sustained discharge source for the production of 1-5 eV beam of O-atoms with a flux of up to 10^{17} O-atoms/s-cm^2. The reactions of atomic oxygen with kapton, Teflon, silver, and various coatings have been studied. The oxidation of kapton has an activation energy of 2.3 Kcal/mole over the temperature range of 25 C to 100 C at a beam energy of 1.5 eV and produces low molecular weight gas phase reaction products (H_2O, NO, CO_2). Teflon reacts with ~0.1-0.2 efficiency to that of kapton at 25 C and both surfaces show a rug like texture after exposure to the O-atom beam. Angular scattering distribution measurements of O-atoms show a near cosine distribution from reactive surfaces indicating complete accommodation of the translational energy with the surface while a nonreactive surface (nickel oxide) shows specular like scattering with little accommodation (50%) of the translational energy with the surface. A technique for simple on orbit chemical experiments using resistance measurements coated silver strips is described. 9 refs., 11 figs.

45548 **(PB—88-207899/XAB) Controle non destructif par hyperfrequence (nondestructive control by hyperfrequency). Final report.** Priou, A.; Assice, A. (Centre d'Etudes et de Recherches de Toulouse (France). Dept. d'Etudes et de Recherches en Micro-ondes). Jul 1987. 37p. (REPT—2/1355-MO). NTIS, PC E04/MF E04.

The authors have demonstrated the feasibility of using a radiometer together with an external excitation source, defining a new nondestructive control procedure for composite materials, a procedure which complements already existing techniques. The authors show that within the validity limits of the theories of blades with parallel faces and the method of radiative transfers there is good agreement between the theoretical results and the experiments (in transmission and reflection). Efforts need now be made to improve the test platform (radiometric captor, better definition of the antenna, optimization of the external excitation source, etc.) and to test materials of different origins.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 44999, 45115, 45411, 45528, 45613, 45633, 45637, 45648, 45916

45549 **(AD-A—192269/9/XAB) Integrated optoelectronic circuits utilizing InGaAsP grown by molecular beam epitaxy (erbium doping of MBE GaAs). Final report, 1 April 1985-31 December 1986.** Meeks, E.L. (Georgia Inst. of Tech., Atlanta (USA). Research Inst.). 1987. 19p. NTIS, PC A03/MF A01.

A study of erbium doping of molecular beam epitaxy(MBE)-grown gallium arsenide layers was initiated. The low-temperature photoluminescence of Er in GaAs was confirmed and the growth conditions necessary to produce Er-doped layers were established. Secondary ion mass spectrometry (SIMS) data on the MBE-grown GaAs:Er doped layers confirm the presence of Er in the layers and the increase in Er doping with source temperature. Photoluminescence measurements on three samples of MBE-grown GaAs:Er layers were very interesting. There is no evidence of any broad background observed in ion-implanted samples. The intense and sharply structured photoluminescence of MBE grown Er-doped GaAs centered around 1.54 micrometers was confirmed.

45550 **(AD-A—192298/8/XAB) Defects in high-mobility semiconductor systems. Interim report No. 2.** Grimmeiss, H. (Lund Univ. (Sweden). Dept. of Solid State Physics). 23 Dec 1987. 3p. NTIS, PC A02/MF A01.

Work under the subject contract was continued in the period 23 Oct thru 23 Dec 1987 on (a) extensive electrical examination of the Pb center on silicon surfaces; (b) preliminary electrical investigation of the new metastable gallium arsenide (GaAs) defect that competes with the EL-2 center; (c) initial EPR measurements on a high ceramic superconductor; and (d) related conceptual studies and tests. The photocapacitance system described in the First Interim Report was applied to an extensive study of the Pb center on oxidized silicon (SI) surfaces. This center is the most-important defect in integrated circuit technology, and serves as an ideal reference for study of other less-well characterized defects.

45551 **(AD-A—192557/7/XAB) Pump-power minimization for high-gain c-w laser amplifiers.** Walther, A.; Sanchez, A. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1 Mar 1988. 5p. (JA—6040). NTIS, PC A02/MF A01.

Pub. in Applied Optics, Vol. 27, No. 5, 828-831(1 Mar 1988).

This paper shows how the power needed to pump a multistage c-w laser amplifier can be minimized by choosing optimum values for the beam area in each stage. Most applications of high-power laser systems demand good beam quality, high efficiency, and frequency stability. A common approach to the design of such systems is the master oscillator-power amplifier configuration. Often the beam quality and stability requirements make it necessary to run the oscillator at powers as low as a fraction of a watt. The amplifier part of the system is then required to provide, with high efficiency, a very large gain, maybe a million or more, to generate the peak power needed. This paper shows how to design the amplifiers to make optimal use of the pump power.

45552 **(AD-A—192837/3/XAB) Solid-state research. Quarterly technical report, 1 May-31 July 1987.** McWhorter, A.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 Aug 1987. 94p. NTIS, PC A05/MF A01.

The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology.

45553 **(LBL—25157) Tuning handbook for the Donner 600 Crystal Tomograph.** Moses, W.W.; Derenzo, S.E. (Lawrence Berkeley Lab., CA (USA)). 25 May 1988. Contract AC03-76SF00098. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014046/JAW.

This document describes the procedures used to tune the Donner 600 Crystal Tomograph. It is broken into three main sections: a conceptual description of the hardware, a description of the tuning algorithms, and a summary of the commands that control the tuning program. The goal of the tuning procedure is to compensate for the variations in timing and gain among the 600 crystals and phototubes in the tomograph. Photon pairs coming from positron annihilation have two important characteristics that allow them to be identified: each photon has a fixed energy (511 keV) and both photons enter the detector ring at the same time. However, crystal to crystal variations in response time make these photons appear to arrive at slightly different times and variations in the gain make the average photon energy appear to be something other than 511 keV. By correcting for these variations so that the relative timing and pulse height is the same for each crystal, the efficiency for detecting positron annihilations is increased and the observed number of random coincidences is reduced. 4 refs., 4 figs., 1 tab.

45554 **(SAND—88-0334C) Multiple pulse photoconductive semiconductor switching.** Zutavern, F.J.; McKenzie, B.B.; Loubriel, G.M.; O'Malley, M.W.; Hamil, R.A.; Schanwald, L.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 18p. (CONF-880699—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011792/JAW.

From 18. power modulator symposium; Hilton Head, SC, USA (20 Jun 1988).

Photoconductive semiconductor switches (PCSS) with short carrier recombination lifetimes (1-100ns) have exhibited comparable opening times in high power (57 kV, 1.0 kA) circuits. Such extremely fast recovery times are not available with the switches generally used for high power (>10kW) switching, e.g., spark gaps, thyratrons, and silicon controlled rectifiers. Furthermore, since these switches were made with relatively small pieces of semiconductor (2.54 cm dia. by 625 μm thick), and since PCSS scales linearly in two dimensions to higher voltages and currents, much higher power switches may be developed. New high power switches which have the ability to open and close in a 1-10 ns time scale provide the tools to switch high power radiofrequency (RF) circuits above 10 MHz actively. This paper presents three methods to create RF bursts with PCSS. The feasibility of each method is explored, and experiments being performed to test these techniques are described. 9 refs., 11 figs.

45555 **(SAND—88-0588C) Air core pulse transformer design.** O'Loughlin, J.P.; Sidler, J.D.; Rohwein, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880699—6). NTIS, PC A02. Order Number DE88012670/JAW.

From 18. power modulator symposium; Hilton Head, SC, USA (20 Jun 1988).

Cylindrical air core pulse transformers capable of passing high voltage/energy pulse waveforms with high efficiency and low distortion require a much more delicate design balance of physical dimensions and electrical parameters that iron or ferrite core units. The two salient advantages of the air core transformer are a much lighter weight and a simplified high voltage insulation system. Special computer codes were written to evaluate the performance. The analysis includes calculation of the self and mutual inductances as determined by the dimensions and insulation stress, evaluation of the waveforms distortion and energy transfer efficiency. Graphical data are given for the optimization in terms of electrical param-

eters. The results are in agreement with experimental data. It is concluded that air core transformers are feasible operating at hundreds of kilovolts and lens of kioljoules in the microsecond region with energy transfer efficiencies of 70% to 85%. The insulation stresses required are in the 100 to 300 kV/em range. Effects of the high frequency current distribution in the windings and the use of "slug" type ferrite cores are also evaluated.

45556 **(SAND—88-1316) A proposed light source for vacuum ultraviolet photolithography.** Smith, A.V. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011762/JAW.

Future high resolution photolithography may require a light source in the wavelength range 185-110 nm. The requirements for such a source are briefly reviewed and alternative sources are compared. Finally, we propose a new source of coherent light near 130 nm based on sum-frequency mixing in Hg vapor. 3 refs., 3 figs.

45557 **(UCID—21436) Through-the-earth communication: Experiment results from Billie Mine and Mississippi Chemical Mine.** Buettner, H.M.; Didwall, E.M.; Bukofzer, D.C. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013162/JAW.

As part of the Lawrence Livermore National Laboratory (LLNL) effort to evaluate "Through-the-Earth Communication" (TEC) as an option for military communication systems, experiments were conducted involving transmission, reception, and performance monitoring of digital electromagnetic communication signals propagating through the earth. The two experiments reported on here not only demonstrated that TEC is useful for transmissions at digital rates above a few bits per second, but also provided data on performance parameters with which to evaluate TEC in various military applications. The most important aspect of these experiments is that the bit error rate (BER) is measured rather than just estimated from purely analytic developments. By measuring this important parameter, not only has more credibility been lent to the "proof of concept" goals of the experiment, but also a means for judging the effects of assumptions in BER theoretical models has been provided. 4 refs., 35 figs., 3 tabs.

45558 **(UCRL—97832) Statistical effects in high-power microwave beam propagation.** Alvarez, R.A.; Bolton, P.R.; Sieger, G.E. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 9p. (CONF-8805132—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012440/JAW.

From 4. national high power microwave conference; Monterey, CA, USA (9 May 1988).

At very high power levels pulsed microwave beams can generate air-breakdown plasmas which may limit the fluence that the beam can transport through the atmosphere. Conventional air breakdown is an avalanche process wherein free electrons, driven by the microwave fields, produce ionization through collisions with air molecules. Propagation of a beam is affected when the plasma electron density approaches the critical density for the particular microwave frequency. The rate of growth of the plasma depends on the competition between the ionization probability and electron loss processes such as attachment and diffusion. The physics of the avalanche process is reasonably well understood, and fluence limits can be fairly accurately predicted, so long as there are free seed electrons to initiate the breakdown. At sea level and low altitudes, seed electrons are, in fact, expected to be fairly rare, and air breakdown, and the consequences for beam propagation, must be treated as a statistical problem; the effective fluence limit may be much greater than would be predicted on the basis of conventional breakdown thresholds. The statistical effects are currently being investigated. 13 refs., 2 figs.

45559 **(UCRL—98909) Extension of the RF pulse duration of a virtual cathode oscillator.** Poulsen, P.; Morrison, J.J. (Lawrence Livermore National Lab., CA (USA)). 13 Jun 1988. Contract W-7405-ENG-48. 6p. (CONF-8805132—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012436/JAW.

From 4. national high power microwave conference; Monterey, CA, USA (9 May 1988).

The total energy emitted by a microwave source is an important factor in determining its utility as a weapon; as a consequence, an effort to extend the pulse length of virtual cathode oscillators (VCOs) was initiated. Typically, the RF ceases prior to the termination of the beam pulse and prior to the plasma closure which is caused by the production of plasma in the anode-cathode gap. Ion contamination of the negative space charge of a virtual cathode oscillator is shown to cause termination of the RF production. We report on initial experiments designed to investigate the effect of vacuum conditions and electrode surface treatments on the RF pulse length and the RF energy production. The pulse length and total RF energy has been increased by a factor of 2-3; the primary cause of the space charge neutralization appears to be ions created at the anode surface. 5 refs., 2 figs., 1 tab.

45560 **Temperature programmed desorptions of tungsten CVD materials.** Heiny, M.A.; McConica, C.M. (Colorado State Univ., Dept. of Agricultural and Chemical Engineering, Fort Collins, CO (US)). pp 69-76 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

Temperature programmed desorption (TPD) studies were conducted on high surface area tungsten and silicon materials following exposure to a typical low pressure chemical vapor deposition (LPCVD) of tungsten in the absence of silicon. The depositions were run at 235°C, and the desorptions were conducted between 245°C and 470°C. It was found that significant amounts of HF desorbed from the tungsten and that SiF/sub 4/ and HF desorbed from the silicon dioxide. Peak description temperature ranges for HF are 375°C to 425°C from SiO/sub 2/ and above 450°C from W. Peak SiF/sub 4/ desorption from SiO/sub 2/ occurred between 325°C and 375°C. Related studies on the interaction of gas phase HF with oxidized wafers indicated that a reactive surface was needed for the attack of the oxide by the HF to proceed. Studies on the effects of reactive and HF concentrations on tungsten nucleation initiation on thermal oxide were also performed. It was found that nucleation can be prevented by the elimination of all reactive surfaces. HF, when controlled amounts were added to the reactor, did not initiate nucleation on oxide surfaces, but appeared to inhibit the H/sub 2/ reduction of WF/sub 6/. Silicon produces SiF/sub 4/ when exposed to WF/sub 6/. These conditions also initiated nucleation on the wafer and on the inert walls of the non-reactive reactor.

45561 **Tungsten deposition in porous silicon for the formation of buried layer conductors.** Blewer, R.S.; Tsao, S.S.; Tracy, M. (Sandia National Labs., P.O. Box 5800, Albuquerque, NM (US)). pp 401-410 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

It has been well established in recent years that silicon can be converted into highly porous material under the appropriate anodic etching conditions. Metallization of such a porous skeleton could be technologically interesting for device applications, especially if the resistance of the metal path could be made sufficiently low. The authors report results on the feasibility of forming buried conductors under single crystal silicon using low pressure chemical vapor deposition of tungsten on the internal surfaces of porous silicon. The infiltration of tungsten into the silicon depends on its porosity, and on tungsten deposition process parameters such as deposition duration, total deposition pressure, and carrier gas species. The resulting tungsten/porous silicon layers were characterized by transmission and scanning electron microscopy, by Rutherford backscattering and X-ray diffraction and by four-point probe resistivity measurements.

45562 **Detrimental effects of residual silicon oxides on LPCVD tungsten depositions in shallow junction devices.** Blewer, R.S.; Tracy, M.E. (Sandia National Labs., P.O. Box 5800, Albuquerque, NM (US)). pp 235-246 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

Integrity of shallow junction devices is dependent on maintaining smooth films of constant thickness where metal contacts doped silicon. Localized silicon oxide residue can enhance the WF/sub 6//Si reaction used in LPCVD tungsten depositions resulting in unacceptably large amounts of silicon consumption. The authors investigated phenomena which cause excess WF/sub 6//Si interaction that can lead to incursions of tungsten into silicon structures. In layers between 1.0 nm and 2.0 nm thick, silicon oxide appears to catalyze the WF/sub 6//Si reaction and prevent or delay the self-limiting condition of LPCVD W film formation. Consequences for shallow junction devices are discussed, and methods to avoid this problem are presented.

45563 **The influence of selective tungsten deposition on shallow junction leakage.** Georgiou, G.E.; Brown, J.M.; Green, M.L.; Liu, R.; Williams, D.S. (Sandia National Labs., Albuquerque, NM (US)). pp 227-234 of Tungsten and other refractory metals for VLSI applications II. Broadbent, E.K. Pittsburgh, PA; Materials Research Society (1987). (CONF-8611130—).

From Workshop on tungsten and other refractory metals for VLSI applications; Palo Alto, CA, USA (12 Nov 1986).

The authors report on the onset of reverse bias diode leakage induced by CVD selective tungsten deposition on (a) shallow n/sup +/(As)/p diodes made by implantation into silicon and (b) n/sup +/(As or P)/p or p/sup +/(BF/sub 2/)/n diodes made by implantation into CoSi/sub 2/. Tungsten, nominally 1000A thick, was selectively deposited in a hot wall tubular reactor using either a one-step or a two-step deposition sequence at 290°C. The n/sup +/(As)/p junctions show an increase in leakage population after tungsten deposition, as the junction depth decreases. The two-step process was found to produce greater leakage in shallow n/sup +/(As)/p junctions than the one-step process. Arsenic implanted junctions show severe degradation in the leakage distribution of shallow diodes beneath CoSi/sub 2/. In contrast to arsenic, shallow junctions made by outdiffusion of phosphorus or boron implanted into CoSi/sub 2/ do not show significant changes in leakage population after selective tungsten deposition. Junction leakage measurements, and their temperature dependence, is correlated with transmission electron micrographs.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 44870

45564 **(PB—88-213004/XAB) EPA (Environmental Protection Agency) manual for waste-minimization-opportunity assessments.** Lorton, G. (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). Apr 1988. 104p. NTIS, PC A06/MF A01.

Waste minimization is a term that includes source reduction and recycling. Source reduction is defined as any activity that reduces or eliminates the generation of wastes at the source, usually within a process. Recycling is defined as the recovery and/or reuse of what would otherwise be a waste material. A waste-minimization opportunity assessment is a procedure for surveying processes and identifying waste reduction possibilities. The manual provides a systematic framework that can be used to carry out a waste minimization opportunity assessment.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 44547, 44870, 44982, 44984, 45303, 45494

45565 (IVA—310, pp 55-63) **Combustion diagnostics.** Holmstedt, G. (Lunds Inst. of Technology, Lund (Sweden). Dept. of Physics). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

The volume of combustion research at our department has grown significantly during the last 4-5 years. The main reason for this is an increase in industrial and governmental interest in the area of combustion processes. Our largest financial support comes from the Swedish Board for Technical Development, STU, which supports our basic laser spectroscopical development and also a project concerning spark ignition. The Gas Research Institute at the Lund Institute of Technology is supporting a project concerning NO production, while Sydkraft AB is sponsoring a project aimed at investigations of the applicability of CARS for temperature measurements in full-scale industrial furnaces. Very recently a project, financially supported by STU and ASEA AB, has been started. This project, which is directed towards the problems in the soot formation process is a joint project with the department of physical chemistry at Chalmers University of Technology. With 27 refs.

4220 Underground Engineering

45566 **(BFR-R—61-1987) Stockholm project. Rock engineering investigation for heat storage in the town block Hoestvetet.** Emmelin, A.; Wahlstroem, L.; Stille, H. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 42p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88753683/JAW.

Heating of the Suncourt building at Hagsaetra is based on heat from a borehole storage in rock. In conjunction with construction of this storage installation, observations were made during production drilling and the rock body was evaluated. The report gives details of practical experiences obtained during the work and on the basis of these gives recommendations for awarding contracts for, and controlling, such projects. The points discussed are precision of drilling, equipment and working conditions. Recommendations are also given as to the way the invitation to tender for a drilling contract should be drawn up, and a suggestion is given as to how payments for the drilling contract should be made. The significance of different parameters for the performance of a borehole store and for the accuracy of location is also set out. The appropriate scope of a preliminary geological and geohydrological investigation, and different investigation methods, are discussed. (authors).

45567 **(NEI-SE—15) Large scale in-situ tests on stress and water flow relationships in fractured rock.** Carlsson, A.; Olsson, T. (Swedish State Power Board, Vaellingby). Jul 1986. 318p. NTIS (US Sales Only), PC A14. Order Number DE88753704/JAW.

The investigations have shown that there exists a well-defined relation between the stress situation and the hydraulic conductivity of a fractured rock mass. The results fit well into the known relationships obtained elsewhere. The conductivity values recorded in boreholes during the exploration stage are not representative for the conductivity in the skin zone surrounding a underground excavation. The testing techniques used have proved to be useful for both deformation modulii determinations and for the present aim. The technique provides an unique tool for determination of the stress relationships. As regards the deformation properties, the loading device presents results which are generally practically adoptable for foundation engineering. The results are reproducable which shows that the technique used measure defined stress-effects on the conductivity. The deformation measurements have been used for more than ten years to define the foundation conditions for turbines in nuclear power plants with an extremely favourable result; none of the foundations has required any additional

measures than those defined by the initial test. The obtained variations with stress and depths seem to be generally accepted; a condition which was not at hand a few years ago. The techniques adopted seem to be acceptable, as well as the water injection procedures.However,the general feeling is that only a minor part of the physical conditions are explained.The change in virgin conditions presented are all based on known relations between stress and conductivity, wherefore an immediate demand on research on this subject is of highest priority.(authors).

4230 Marine Engineering

REFER ALSO TO CITATION(S) 44644, 44647, 44648, 44649, 44680, 44996, 45890

45568 (IKU-P—01.0051.00/01/86) **Marine fouling removal.** Bugten, B.; Martinsen, A. (Institutt for Kontinentalundersoekelser og Petroleumsteknologi A/S, Trondheim (Norway)). Mar 1986. 22p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753690/JAW.

The report deals with shock wave experiments regarding marine fouling removal suck as chalk substances and forge scales etc. The device used in the experiments, is equipped with acoustic lenses. There is a need for further development in this field. In addition, a litterature study on remote controlled belt brush tools for submerged structures such as support pillars and marine nisers is presented, and an evaluation of the power demand for such types of tools is given. 13 drawings, 1 table.

45569 (NEI-NO—44, pp 135-150) **MDC: A remote controlled manipulator system for diverless connections and repair of flexible lines.** Burckbuchler, C.; Lecombe, H.; Barthelemy, B. (Ugland Conflexip A/S, Stavanger (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

Thanks to the specific mechanical properties of flexible flowlines, electrical cables and umbilicals, Coflexip is developing a new diverless methodology to perform connections and repair of these flexible lines which would significantly improve reliability thus reducing their costs, down to a water depth of 1000 m. A heavy duty telemanipulator arm is under design, which grabs the line which has been laid on the seabed, and brings it to the other part to be connected (subsea structure, rigid or flexible line). This telemanipulator arm can be fitted either on an autonomous vehicle crawling on the seabed, or on a running tool lowered on the subsea structure, depending on the job to be performed. Furthermore, Coflexip, together with the Institut Francais du P-trole has developed an original acoustic detection and command system which, with the temanipulator arm, enables the automatic horizontal connection of a line, using a standard collet connector. After three offshore tests, the first taking place in spring 1986, the system, named MDC, is scheduled to be operational by 1988. 10 drawings.

45570 (NEI-NO—44, pp 225-242) **Maintenance options for a hybrid subsea manifolding system. Subsea Atmospheric System Development Project.** Schei, E. (Kvaerner Brug A/S, Oslo (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper describes in brief the Subsea Atmospheric System (SAS) currently being jointly developed by Mobil, Kvaerner and Statoil. A description of the hybrid concept is presented and the concept of splitting the maintenance into wet (hyperbaric) and dry (one atmospheric) is outlined. The concept of a hybrid system is to divide the subsea components into two categories: those requiring re-entry into the high pressure wellstream components, and those involving more complex control and manifolding components. A description of each class of maintenance has been provided and comparisons with state of the art techniques are made where appropriate. The paper also addressess surface support requirements for each type of maintenance activity and gives examples of typical maintenance scenarios. 12 drawings.

45571 (NEI-NO—44, pp 277-304) **Installation of subsea protection structures-procedures and costs.** Koch, E. (Inocean Construction A/S, Bergen (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper concerns procedures and costs for the installation of subsea protection structures. Over the last years several field developments featuring sub sea completions has emerged in the North Sea Area. Future field developments based on subsea completion systems and specialized installation equipment for such installations is briefly discussed. Several structure construction parameters have major influence on the overall cost efficiency of an installation. Some significant factors are listed and the possibility to canalize operational experience back into the field development project is proposed. General work tasks are defined and related cost distribution for different project phases and cost elements given. In ocean Construction A/S installed 5 subsea protection structures for Statoil at Gullfaks A in August 1985. This project comprises all operations normally required and is used as a practical example of subsea strucutre installation procedures. 18 drawings.

45572 (NEI-NO—44, pp 305-322) **Norske Shell diving and subsea intervention studies.** Norton, W.B. (Norske Shell A/S, Stavanger (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

The paper describes the history behind Norske Shell's Diving and Subsea Intervention Studies for the Troll Field and the development of a deep diving programme. The results of the studies on divers personal equipment, human factors and engineering aspects are summarised. The culmination of the project was a manned simulated dive to 450 msw, the objectives and results of which are described. 4 drawings.

45573 (NEI-NO—44, pp 413-430) **Long distance TLF wear testing.** Harkrider, B.M.; Shaw, M.N. (Exxon Production Research Company, Houston (US); Esso Australia Ltd., Stavanger (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

One of the chief concerns with long distance TFL operations is wear of the TFL tools. A test program conducted by Esso in 1994 has shown that tool wear is within acceptable limits for subsea wells at distances of at least 20 kilometers (65,000 feet) from a support platform, using available TFL tool designs. This represents a threefold increase over current industry experience, since TFL servicing has been conducted heretofore through flowline lengths of 7.2 kolimeters (23,600 feet) of less. The TFL components known to be subject to wear-related problems were tested by being pumped through the service flowline connecting the Cobia-2 subsea completion to the Mackerel platform in Bass Strait. These flowlines were selected for this test program to provide more realistic data than that possible from a surface TFL test loop. Quantitative measurements of wear were taken on piston units (locomotives), wear rings, molded seals and locator keys. These measurements were supplemented by functional testing of the tools in a surface test fixture. The paper will describe in detail the tools, test equipment, procedures and results. The results of the test program give encouragement that TFL maintenance techniques can be used in increasingly remote applications. 9 drawings, 2 tables.

45574 (NEI-NO—44, pp 431-449) **Light maintenance of subsea installations from surface support vessels.** Boehlerengen, M.; Pedersen, T.H. (Wiltec, Oslo (Norway); Norwegian Petroleum Consultants A/S, Asker (Norway)). 1986. NTIS (US Sales Only), PC A24. Order Number DE88753699/JAW. (CONF-860481—).

From Underwater technology conference; Bergen, Norway (14 Apr 1986).

This paper presents the major aspects of light maintenance of subsea installations from surface support vessels such as: relevant

maintenance operations; definitions of probable durations and frequencies of typical maintenance operations; definitions of functional and equipment requirements to support vessel; definitions of alternative vessel configurations; evaluation of alternative vessel concepts with respect to vessel regularities and costs. The general conclusion of the study is that a monohull is more costefficient than a semi-submersible vessel. This is largely outweighed by a better regularity of the latter concept. The choice of concept, size and equipment is, however, dependant on the particular fields in question as well as the philosophy of the operator. 1 drawing, 5 tables.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 44940, 44941, 45565

45575 (IVA—310, pp 65-102) NO/sub x/ control by combustion modification in power plants. Schuster, H. (Deutsche Babcock Werke AG, Oberhausen (Federal Republik of Germany)). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

The efforts are focussed on primary measures aiming at a suppression of NO/sub x/ formation by combustion modifications. For this purpose of low-NO/sub x/ firing systems were developed and tested which achieve a reduction of NO/sub x/ emissions by at least 40% compared with conventional firing systems. In pursuance of the energy-political objectives, development concentrated on the fuel coal. In the meantime, these firing systems have proved successful in full-scale operation in a few plants. The operating experience gained shows that the emission standards of the Grossfeuerunganlagen-Verordnung can be met by primary measures and under certain conditions even lower values can be achieved. There are still restrictions for smaller plants and certain fuel qualities. Further development of firing systems aiming at a still greater reduction of NO/sub x/ emissions is being actively pursued. The developed low-NO/sub x/ firing systems are used in new plants and, in many cases, also in existing plants by retrofitting. These primary measures do frequently not suffice to attain the NO/sub x/ levels established by the Conference of Secretaries of State for Environment in a resolution of April 5, 1984 for limiting NO/sub x/ emissions form large firing systems. Rather, the basic assumption is made that both in new plants and existing plants to be operated for an unlimited period of time of a furnace heat input of more than 300 MW secondary measures for reducing nitrogen oxide levels will have to be adopted in addition to the primary furnace-oriented measures. The costs for NO/sub x/ removal form the flue gas are normally considerably higher than for combustion modifications. With 20 refs.

4250 Power Cycles

REFER ALSO TO CITATION(S) 45323, 45324

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

45576 (BNL—41366) The RHIC [Relativistic Heavy Ion Collider] lattice. Lee, S.Y.; Claus, J.; Courant, E.D.; Dell, G.F.; Hahn, H.; Parzen, G.; Ruggiero, A.G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-880695—18). NTIS, PC A02. Order Number DE88012524/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

An antisymmetric lattice for the proposed Relativistic Heavy Ion Collider at Brookhaven National Laboratory is presented. It has been designed to have an energy range from 7 GeV/amu up to 100 GeV/amu; a good tunability of B^* and betatron tune; capability of operating unequal species, for example, proton on gold. Suppression of structure resonances is achieved by proper choice of the phase advances across the insertions and the arc cells. 9 refs., 6 figs., 1 tab.

45577 (BNL—41394) Code comparison for accelerator design and analysis. Parsa, Z. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880695—45). NTIS, PC A02. Order Number DE88012895/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

We present a comparison between results obtained from standard accelerator physics codes used for the design and analysis of synchrotrons and storage rings, with programs SYNCH, MAD, HARMON, PATRICIA, PATPET, BETA, DIMAD, MARYLIE and RACE-TRACK. In our analysis we have considered 5 (various size) lattices with large and small angles including AGS Booster (10{degree} bend), RHIC (2.24{degree}), SXLS, XLS (XUV ring with 45{degree} bend) and X-RAY rings. The differences in the integration methods used and the treatment of the fringe fields in these codes could lead to different results. The inclusion of nonlinear (e.g., dipole) terms may be necessary in these calculations specially for a small ring. 12 refs., 6 figs., 10 tabs.

45578 (CERN-EP—88-01) Future facilities for particle physics. Rubbia, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 6 Jan 1988. 17p. (CONF-870797—16). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012609/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

There is no doubt that a new generation of higher energy accelerators is necessary in order to further perfect our picture of matter. As a broad guess, it is believed that the next energy domain {Omicron} (1 TeV), in other words, about one order of magnitude higher energy in the constituents frame, will eventually be rich of experimental surprises. Only colliding beams, in various forms of [p-p], [e^+-e^-] and [e^--p] can provide the practical instruments to have access to these energies. In addition to the highest energies there are also new, crucial experiments at low energies. The new, important discovery of the B^0–B^0 oscillations, first made at CERN-UA1 and now beautifully confirmed here at DORIS has opened a new, powerful way of exploring the origin of CP violation. A "Beauty Factory", namely a e^+e^- collider of very high luminosity $L \geq 10^{34}\ cm^{-2}\ s^{-1}$ tuned on Y resonances around 10 GeV is a very rich and promising machine which should be built. In spite of the enormous efforts in studying the CP violation phenomenon--which most certainly has relevance also with Cosmology and the early moments of the universe--we do not know today much more of what we knew twenty years ago, at the times of the early discoveries. This paper considers future particle physics facilities to find answers to current questions. 7 figs., 1 tab.

45579 (CERN-EP—88-11) An experimentalist's overview of the parallel development of accelerators and detectors. Amaldi, U. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Jan 1988. 15p. (CONF-8706296—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012612/JAW.

From ICFA school on instrumentation in elementary particle physics; Trieste, Italy (8 Jun 1987).

This paper covers milestones in development of accelerators; the rise and fall of bubble chambers; and detectors and accelerators of the future. 13 refs., 9 figs., 2 tabs.

45580 (CONF-880841—12) The HVEM-Tandem user facility at Argonne National Laboratory. Allen, C.W.; Ryan, E.A.; Ockers, S.T. (Argonne National Lab., IL (USA)). Mar 1988. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010093/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

45581 **(FNAL-TM—1527) The use of the Fermilab antiproton Accumulator in medium energy physics experiments.** Bharadwaj, V.; Church, M.; Harms, E.; Hsueh, S.Y.; Kells, W.; MacLachlan, J.; Marsh, W.; McCarthy, J.; Pastrone, N.; Peoples, J. (Fermi National Accelerator Lab., Batavia, IL (USA)). 7 Jun 1988. Contract AC02-76CH03000. 3p. (CONF-880695—47). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014195/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The Fermilab antiprotron Accumulator has been modified for use in a medium energy experiment. The experiment is conducted with circulating antiproton beam of momentum between 6.7 GeV/c and 3.7 GeV/c colliding with protons from an internal gas jet. Antiprotons are accumulated at the normal momentum of 8.9 GeV/c and then decelerated to the appropriate energy. It is necessary to cool the beam continually during the time it is colliding with the gas jet. The experiment requires new provisions for the control of magnet power supplies and low level rf system and modifications of the cooling system and high level energy systems to permit variable energy operation. Transition must be crossed to decelerate the beam below 5 GeV/c; because the deceleration is very slow, transition can not be crossed in a conventional manner. This paper will describe the required changes to the Accumulator and operating experience with protons. 8 refs., 2 figs., 1 tab.

45582 (INIS-mf—11260, pp 20) **Physics at HERA: The first electron-proton collider.** Montag, A. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45583 **(SAND—88-0463C) Hermes III: A TW, short pulse, gamma ray simulator.** Ramirez, J.J.; Prestwich, K.R.; Alexander, J.A.; Corley, J.P.; Denison, G.J.; Huddle, C.W.; Johnson, D.L.; Pate, R.C.; Weber, G.J.; Burgess, E.L.; Hamil, R.A.; Poukey, J.W.; Sanford, T.W.L.; Seamons, L.O.; Zawadzkas, G.A.; Smith, I.D.; Spence, P.W.; Schlitt, L.G. (Sandia National Labs., Albuquerque, NM (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880713—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012667/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Hermes III is a 22-MV, 730-kA, 40-ns accelerator that powers an electron beam diode/converter to generate a pulse of bremsstrahlung radiation. It delivers a peak dose rate of 5 x 10{sup 12} Rads(Si)/sec. The radiation pulse has a rise time and FWHM of {approximately}20 ns. The accelerator uses eighty 1.1-MV, 220-kA pulses and adds them in a parallel/series arrangement using twenty inductive cavities and self magnetically insulated transmission lines (MITLs) to generate the output pulse that drives the diode. The overall configuration of Hermes III is presented together with a discussion of the design of the various subsystems. Results from initial testing indicate that the facility is performing at or near peak design specifications. Extension of this technology to light ion beam drivers is also discussed. 19 refs., 7 figs.

45584 **(SLAC-TN—88-1) Quality assurance manual: Volume 1.** Oijala, J.E. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1988. Contract AC03-76SF00515. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013029/JAW.

Stanford Linear Accelerator Center (SLAC) is a DOE-supported research facility that carries out experimental and theoretical research in high energy physics and developmental work in new techniques for particle acceleration and experimental instrumentation. The purpose of this manual is to describe SLAC quality assurance policies and practices in various parts of the Laboratory.

45585 **(SLAC-TN—88-2-Vol.2) Quality assurance manual: Volume 2, Appendices.** Oijala, J.E. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1988. Contract AC03-76SF00515. 398p. NTIS, PC A17. Order Number DE88013880/JAW.

This paper contains quality assurance information on departments of the Stanford Linear Accelerator Center. Particular quality assurance policies and standards discussed are on: Mechanical Systems; Klystron and Microwave Department; Electronics Department; Plant Engineering; Accelerator Department; Purchasing; and Experimental Facilities Department. (LSP)

45586 **(TRI-PP—88-40) Recent developments on the TRIUMF Kaon Factory proposal.** Craddock, M.K.; Baartman, R.; Burge, R.; Enegren, T.; Koscielniak, S.; Laxdal, R.E.; Mackenzie, G.H.; Poirier, R.L.; Reiniger, K.; Servranckx, R.V.; Suzuki, T.; Wienands, U.; Zach, M. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1988. 3p. (CONF-880695—36). NTIS (US Sales Only), PC A02. Order Number DE88013271/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The TRIUMF KAON Factory proposal has made considerable progress on both technical and political fronts over the last year. A racetrack-shaped lattice is now being considered in conjunction with a three-element slow extraction system in a effort to reduce losses to the 0.1% level. Hardware studies have continued on both magnet power supplies and on rf cavities--- the latter work gaining an extra dimension from a recently-instituted formal collaboration with LAMPF. The H/sup {minus}/ extraction system for the cyclotron has been tested successfully with 66 μA pulsed 10 μA average beams. On the political side, British Columbia has agreed to fund the buildings and tunnels (Cdn $87M) and is making the KAON Factory its top priority project with the Canadian federal government. A joint federal-provincial delegation has traveled abroad and found that a number of countries would consider significant contributions to the cost. Approval of $11 million in pre-construction R&D funds is expected imminently, permitting formal negotiations to start abroad, with final approval for construction coming in 1989.

4302 Beam Dynamics, Field Calculations, And Ion Optics

45587 **(BNL—41358) Synchronous particle and non-adiabatic capture.** Kats, J.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-880695—24). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013789/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

In the theory of particle longitudinal motion, a classical definition of synchronous particle (synchronous energy, phase, and orbit) assumes that there is a one-to-one correspondence between the guiding magnetic field and the frequency of the accelerating electrical field. In practice, that correspondence may not be sustained because of errors in the magnetic field, in the frequency, or because sometimes one does not want to keep that relationship for some reason. In this paper, a definition of synchronous particle is introduced when the magnetic field and the frequency are independent functions of time. The result is that the size and shape of the bucket (separatrix) depends not only on the field rate of change but also on the frequency rate of change. This means, for example, that one can have a stationary bucket even with a rising field. Having the frequency, in addition to the field and voltage, as parameters controlling the shape and the size of the bucket, it is shown how to decrease particle losses during injection and capture. 2 refs., 2 figs.

45588 **(BNL—41393) Tracking studies on a RHIC lattice configuration for crossing the transition energy.** Dell, G.F.; Parzen, G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-880695—19). NTIS, PC A02. Order Number DE88012887/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Particle tracking has been performed on RHIC when special quadrupoles in the arcs are used to produce a jump in the transition gamma. Studies include: worst case (full powering of the special quadrupoles) to determine the stability limit of the motion, and tracking of a particle throughout the γt pulse to test if the motion is stable for the required 47,000 turns. 4 refs., 7 figs.

45589 **(CERN-EP—87-198) MICROLEAR: Deceleration of antiprotons in a cooling electron beam.** Medenwaldt, R.; Poth, H.; Schwab, W.; Seligmann, B.; Woertge, M.; Wolf, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 21 Oct 1987. 4p. (CONF-8709160—6). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88012604/JAW.

From 4. LEAR workshop; Villars-sur-Ollon, Switzerland (6 Sep 1987).

The deceleration of antiprotons from LEAR in a compact circular machine using friction in an electron beam is proposed. The basic layout of the device, slowing-down times and beam lifetimes are discussed. 8 refs., 2 figs., 1 tab.

45590 **(FNAL-TM—1528) Study of two-dimensional transient cavity fields using the finite-difference time-domain technique.** Crisp, J.L. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1988. Contract AC02-76CH03000. 99p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014197/JAW.

This work is intended to be a study into the application of the finite-difference time-domain, or FD-TD technique, to some of the problems faced by designers of equipment used in modern accelerators. In particular it discusses using the FD-TD algorithm to study the field distribution of a simple two-dimensional cavity in both space and time. 18 refs.

45591 **(LA-UR—88-1200) Toward automatic control of particle accelerator beams.** Schultz, D.E.; Silbar, R.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880853—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009140/JAW.

From 3. international conference on applications of artificial intelligence in engineering; Stanford, CA, USA (8 Aug 1988).

We describe a program aiming toward automatic control of particle accelerator beams. A hybrid approach is used, combining knowledge- based system programming techniques and traditional numerical simulations. We use an expert system shell for the symbolic processing and have incorporated the FORTRAN beam optics code TRANSPORT for numerical simulation. The paper discusses the symbolic model we built, the reasoning components, how the knowledge base accesses information from an operating beamline, and the experience gained in merging the two worlds of numeric and symbolic processing. We also discuss plans for a future real-time system. 6 refs., 6 figs.

45592 **(SAND—87-3126C) Ion focusing experiments on PBFA II.** Lockner, T.R.; Johnson, D.J.; Leeper, R.J.; Maenchen, J.E.; Ruiz, C.L.; Stygar, W.A.; Mehlhorn, T.A.; Bailey, J.E.; Rosenthal, S.E.; Coats, R.S.; Quintenz, J.P.; Desjarlais, M.P.; Kensek, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880713—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012706/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

The operation of an applied-B ion diode on PBFA II is described. With the accelerator operating at 1/2 energy 500 kJ of electrical energy was coupled to the diode with over 400 kJ in the beam. The beam was composed of 50% protons. Typical diode parameters were 5 MV voltage, 3 MA current, and 60 ns duration. A beam diagnostic package with K/sub α/ and Rutherford scattering pinhole cameras, a magnetic spectrograph, and nuclear activation apparatus is used to determine most of the significant beam parameters. This package showed a significant energy spread in the beam, small spot size on axis for small effective gap sizes, a carbon fraction consistent with previous experiments, and significant beam sweeping in focal length due to self B-field bending in the AK gap and applied B-field bending in the drift region of the beam. 3 refs., 5 figs.

45593 **(SLAC-CN—364) Difference orbits and BPM-resolutions.** Emma, P.; Lohse, T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 20 Jun 1988. Contract AC03-76SF00515. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013255/JAW.

In the interaction region of the SLC, the information of beam position monitors (BPM) is used to get crucial information on the beam parameters, like the position, the inclination, or the deflection of the beams at the interaction point. The information is usually extracted from the BPM readings by fitting orbits, using the known twiss parameters at the BPM positions. The quality of these fits depends, however, on the assumed resolutions of the BPMs. This is a particularly serious problem in the interaction region, since BPMs with quite different resolutions and very different values for the beta-function have to be combined. This note presents a method which allows empirical extraction of BPM-resolutions from the orbit-fits. The method has been originally developed in reference. It has been tested by Monte Carlo simulations and successfully exploited for the measurement of spatial resolutions of a time projection chamber. 2 refs., 3 figs., 5 tabs.

45594 **(SLAC-PUB—4540) A beam energy analysis and monitoring system for linear accelerators.** Lee, M.J.; Kleban, S.D.; Zambre, Y.B.; Seeman, J.T.; Adolphsen, C.E.; Abrams, G.S.; Iverson, R.; Stanek, M.; Turner, J.L.; Blanchette, C.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1988. Contract AC03-76SF00515;AC03-76SF00098. 4p. (CONF-880695—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012728/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A model-based beam orbit simulation program has been used successfully to analyze the beam energy errors at the two-mile linear accelerator during commissioning of the SLC system. This simulation program has also been used to develop a nondestructive beam energy error monitoring system. The method of analysis, the simulation program, and a beam energy analysis and monitoring system using expert systems techniques will be described.

45595 **(SLAC-PUB—4618) The calculated longitudinal impedance of the SLC [Stanford Linear Collider] damping rings.** Bane, K.L.F. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1988. Contract AC03-76SF00515. 3p. (CONF-880695—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012731/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A high level of current dependent bunch lengthening has been observed in the north damping ring of the Stanford Linear Collider (SLC), indicating that the ring's impedance is very inductive. This level of bunch lengthening will limit the performance of the SLC. In order to study the problem of bunch lengthening in the damping ring and the possibility of reducing their inductance we compute, in this report, the longitudinal impedance of the damping ring vacuum chamber. More specifically we find the response function of the ring to a short gaussian bunch. This function will later be used as a driving term in the longitudinal equation of motion. We also identify the important inductive elements of the vacuum chamber and estimate their contribution to the total ring inductance. This information will be useful in assessing the effect of vacuum chamber modifications. 7 refs. , 8 figs., 1 tab.

45596 **(SLAC-PUB—4620) Bunch length and impedance measurements in SPEAR.** Bane, K.; Donald, M.; Hofmann, A.; Jowett, J.; Lockman, W.; Morton, P.; Stege, R.; Spence, W.; Wilson, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1988. Contract AC03-76SF00515. 4p. (CONF-880695—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012732/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Subsequent to an extensive smoothing of the vacuum chamber a comprehensive study of the SPEAR impedance was undertaken. Bunch length, synchrotron quadrupole mode frequency, and parasitic mode loss were measured as functions of beam current. The results showed that, although the gross longitudinal impedance had indeed been reduced, the 'capacitive' component had also decreased relative to the 'inductive'--to the extent that previously compensated potential well distortion now induced bunch lengthening at low currents, and the turbulent threshold had actually been lowered. A specially designed multi-cell disc-loaded 'capacitor' cavity was shown to be capable of removing this effect by restoring the original compensation. A model of the new SPEAR impedance is also obtained. 7 refs., 6 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 45592, 45614, 46175, 46176, 46177, 46178, 46203

45597 **(ANL/APS-TM—3) Synchrotron x-ray sources and new opportunities in the earth sciences: Workshop report.** Sutton, S.; Rivers, M. (Argonne National Lab., IL (USA)). Apr 1988. Contract W-31109-ENG-38. 127p. (CONF-880194—). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88009858/JAW.

From Workshop on synchrotron X-ray sources and new opportunities in the earth sciences; Argonne, IL, USA (18 Jan 1988).

Separate abstracts were prepared from six chapters in these workshop proceedings.

45598 **(BNL—41373) A high harmonic cavity for controlled longitudinal phase space dilution in the AGS.** Brennan, J.M.; Ahrens, L.; Cameron, P.; Frey, W.; Goldman, M.A.; Kasha, D.; Kats, J.; McNerney, A.; Raka, E.; Sanders, R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-880695—29). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013784/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A harmonic cavity at 93 MHz is being built that will be used in the Brookhaven AGS to perform a controlled blow up of the longitudinal phase space in order to facilitate lossless passage through the transition energy. The phase space area will be increased from 1.0 eV- s to as much as 4.0 eV-s on two 50 ms magnetic field flattops. The cavity is a shorted quarter wave TEM mode cavity that provides 30 kV of gap voltage for less than 10 kW of drive power. When the cavity is not in operation it will be switched to a low-impedance state by a PIN diode switch. 5 refs., 3 figs., 1 tab.

45599 **(BNL—41374) A fast chopper for programmed population of the longitudinal phase space of the AGS Booster.** Brennan, J.M.; Ahrens, L.; Alessi, J.; Brodowski, J.; Kats, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880695—26). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013787/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A fast chopper has been built that can switch the beam injected into the AGS or AGS Booster on and off with rise and fall times in the order of 10 ns. The chopper will be used to control the initial population of longitudinal phase space in order to eliminate rf capture losses and achieve an optimal phase space density distribution. The chopper operates on the 35 keV H/sup {minus}/ beam between the ion source and the RFQ. The interaction between the electrostatic fields of the chopper and the space charge neutralizing ions in the beam has been seen to be a significant but manageable effect. 5 refs., 5 figs.

45600 **(BNL—41375) Advances in BNL's polarized ion source development.** Alessi, J.; DeVito, B.; Herschcovitch, A.; Kponou, A.; Meitzler, C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880695—27). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013786/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Polarized protons have been accelerated in the AGS to 22{yield} GeV. The polarized source presently used produces 30-40 μA of {rvec char}H^- at 75-80% polarization, in 500 μs pulses, 0.5 Hz. This is three orders of magnitude lower in intensity than normal H^- operation, and higher intensities are desired. There is a program in the AGS department to develop a higher intensity source. This is a ground state atomic beam source with an atomic beam cooled to 6 K, spin selection and focusing via a superconducting solenoid (shown) or a sextupole system, and an ionizer for {rvec char}H^- production based on the charge exchange of {rvec char}H{degree} with D^-. Work is in progress on all three components, and will be described in this paper. 6 refs., 7 figs.

45601 **(BNL—41377) Studies of pulsed volume sources of H^- ions.** Prelec, K. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-880695—23). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013790/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

As part of the improvement program at the BNL Alternating Gradient Synchrotron (AGS), a new RFQ preinjector and its beam line are being assembled. While the modified H^- magnetron source of the plasma-surface type is the first choice to be used in the new preinjector, work is in progress to develop a 50 mA, low emittance volume-type H^- ion source that would not require a continuous injection of cesium vapors into the source chamber. Studies of the effect of different cusp configurations were done on a source model with a diameter of 12.5 cm and a length of 20 cm. Highest yields were obtained with linear and circular cusps, while the performance of checkerboard cusps was inferior. More than 20 mA of H^- beam current was recorded on a Faraday cup, corresponding to a current density in the extraction aperture of more than 25 mA/cm^2. A second model was then designed, constructed, and initial tests performed. It features a very low length-to-radius ratio of 0.6, cusps covering the whole discharge chamber, and the possibility to use a conical dipole field separating the outside, toroidal discharge chamber and the central extraction chamber. So far, an H^- beam current of close to 10 mA was obtained, at an arc current of 200 A. Further tests, with the objective of optimizing the magnetic field configuration, will be performed this year. 6 figs., 1 tab.

45602 **(FNAL/C—88/72) The Fermilab Collider D{Phi} low B system.** McInturff, A.D.; Carson, J.; Collins, T.; Koepke, K.; Malamud, E.; Mantsch, P.; Niemann, R.; Riddiford, A. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1988. Contract AC02-76CH03000. 4p. (CONF-880695—21). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013219/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A new low B system has been designed to serve the detector facility under construction at the D{Phi} location of the Fermilab Superconducting Collider. The low B system consists of 18 special cold iron quadrupoles powered as 11 independent circuits that can adjust the B value at the intersection point down to 25 cm. Low beta is achieved with a set of 1.4 T/cm, two shell, high current quadrupoles. Smaller 0.7 T/cm, single shell trim quadrupoles are used to match the low beta insertion to the rest of the accelerator lattice. Gaps have been left in the lattice for electrostatic separators to separate the proton and antiproton beams everywhere except at the desired collision points. 6 refs., 6 figs., 3 tabs.

45603 **(FNAL-TM—1531) Conceptual design of a superconducting solenoid for a magnetic SSC [Superconducting Super Collider] detector.** Fast, R.W.; Grimson, J.H.; Kephart, R.D.; Krebs, H.J.; Stone, M.E.; Theriot, D.; Wands, R.H. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1988. Contract AC02-76CH03000. 6p. (CONF-880736—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014709/JAW.

From 12. international cryogenic engineering conference and exhibition; Southhampton, UK (12 Jul 1988).

The conceptual design of a large superconducting solenoid suitable for a magnetic detector at the Superconducting Super Collider (SSC) has begun at Fermilab. The magnet will provide a magnetic field of 2 T over a volume 8 m in diameter by 16 m long. The particle-physics calorimetry will be inside the field volume and so the coil will be bath cooled and cryostable; the vessels will be stainless steel. Predictibility of performance and the ability to safely negotiate all probable failure modes, including a quench, are important items of the design philosophy. Although the magnet is considerably larger than existing solenoids of this type and although many issues of manufacturability, transportability and cost have not been completely addressed, our conceptual design has convinced us that this magnet is a reasonable extrapolation of present technology. 2 figs., 2 tabs.

45604 **(IFVE-OKU—87-55) SM-4 computer application software for data processing, displaying and recording in the system of beam extraction control for the IHEP accelerator.** Afonin, A.G.; Prisyazhnykh, S.G.; Sokolov, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702858/JAW.

Intensity of U-70 beams in an accelerator in connection with use of a new injection complex and new high-intense channels of particles makes high demands of extracted beam parameters, of extraction systems operation stability during a seance. To provise effective complex operation, a system of beam extraction control based on program-compatible mini- and macrocomputers of the SM-4 and "Electronics-60" types has been developed. Organization and functioning of applied software solving by the SM-4 computer problems of data processing, recording and displaying in the extraction control system are considered. Software provides two parallel processes: data processing and displaying in the real time mode as well as dialogue with an operator. Software includes several applied programs each of which processes data from a certain subsystem, and program of communivation with an operator providing command receipt and communication with rest programs. Besides main programs there is quite a number of additional programs. 4 refs.; 1 tab.

45605 **(LBL—24431) On-line velocity measurements using phase probes at the SuperHILAC.** Feinberg, B.; Meaney, D.; Thatcher, R.; Timossi, C. (Lawrence Berkeley Lab., CA (USA)). Dec 1987. Contract AC03-76SF00098. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014066/JAW.

Phase probes have been placed in several external beam lines at the LBL heavy ion linear accelerator (SuperHILAC) to provide non- destructive velocity measurements independent of the ion being accelerated. The system uses three probes in each line to obtain accurate velocity measurements at all beam energies. Automatic gain control and signal analysis are performed so that the energy/nucleon along with up to three probe signals are displayed on a vector graphics display with a refresh rate better than twice per second. The system uses a sensitive pseudo-correlation technique to pick out the signal from the noise, features simultaneous measurements of up to four ion velocities when more than one beam is being accelerated, and is controlled by a touch-screen operator interface. It is accurate to within {+-}0.25% and has provisions for on-line calibration tests. The phase probes thus provide a velocity measurement independent of the mass defect associated with the use of crystal detectors, which can become significant for heavy elements. They are now used as a routine tuning aid to ensure proper bunch structure, and as a beam velocity monitor. 3 refs., 5 figs.

45606 **(LBL—25291) Vacuum system for the LBL advanced light source (ALS).** Kennedy, K. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 8p. (CONF-880552—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013602/JAW.

From Vacuum design of advanced and compact synchrotron light sources; Upton, NY, USA (16 May 1988).

A 1.5 to 1.9 GeV synchrotron light source is being built at LBL. The vacuum system is designed to permit all synchrotron photons on the median plane to escape the electron channel and go into an antechamber through a 10 mm high slot. This slot offers effective RF isolation between the electron duct and the antechamber. All unused synchrotron photons within a few mrad of the median plane will be stopped by 96 nearly horizontal absorbers located in the antechamber. The gas, generated by the photons hitting the absorbers, will be directed down to reactive titanium surfaces. Twelve 10 meter long vessels constitute the vacuum chambers for all the lattice magnets. Each chamber will be machined from two thick plates of 5083-H321 aluminum and welded at the perimeter. The nominal wall thickness of the vacuum chamber is 40 mm, which makes it possible to machine a flange into the chamber without the use of welding. 5 refs., 5 figs.

45607 **(SAND—87-3048C) Test of extended-planar-anode diode on HERMES III.** Sanford, T.W.L.; Halbleib, J.A.; Poukey, J.W.; Baldwin, G.T.; Carlson, G.A.; Stygar, W.A.; Sheridan, T.; Mock, R.; Borkey, T.A.; Crowder, G.W.; Current, M.F.; Ives, H.C.; Mastin, G.A.; Pate, R.C.; Douglas, G.; Brock, E.R.; Alexander, J.A.; Landron, C.O.; Spence, P.W.; Bailey, V.L.; Kishi, H. (Sandia National Labs., Albuquerque, NM (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880713—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012391/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

The behavior of a diode having an extended planar anode on HERMES III is measured and compared with predictions of a model that combines a particle-in-cell code with Monte Carlo radiation transport. The comparisons confirm the modeling and show that the diode provides both a matched load and a flexible large-area γ-ray source for study of nuclear radiation effects. Measured electrical parameters of the diode and downstream radiation fields are presented. 11 refs., 5 figs.

45608 **(SAND—88-0064C) Intense light-ion-beam diodes.** Cook, D.L.; Desjarlais, M.P.; Slutz, S.A.; Lockner, T.R.; Johnson, D.J.; Rosenthal, S.E.; Bailey, J.E.; Coats, R.S.; Leeper, R.J.; Maenchen, J.E.; Mehlhorn, T.A.; Pointon, T.D.; Quintenz, J.P.; Ruiz, C.L.; Stinnett, R.W.; Stygar, W.A.; VanDevender, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880713—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012859/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Intense light ion beam diodes are being developed as sources for Inertial Confinement Fusion. Research efforts are being carried out world wide. Progress in understanding the physics of ion diodes has been rapid. In particular, diodes using externally applied magnetic fields have been scaled to very large levels of power and energy on the Particle Beam Fusion Accelerator (PBFA II) at Sandia National Laboratories. Our present understanding of the physics of these diodes is described, and critical issues which need to be addressed in future research are discussed. 35 refs., 6 figs.

45609 **(SAND—88-0373C) Lithium ion source experiments on PBFA II [Particle Beam Fusion Accelerator II].** Bieg, K.W.; Lockner, T.R.; Pregenzer, A.L.; Woodworth, J.R.; Desjarlais, M.P.; Gerber, R.A.; Johnson, D.J.; Leeper, R.J.; Maenchen, J.E.; McKay, P.F. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880713—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012705/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

In conjunction with Applied-B ion diode focusing experiments on PBFA II, we are beginning lithium ion source experiments with a solid lithium fluoride "field-enhanced" source and a liquid electrohydrodynamic (EHD) source. In addition to the conventional electrical measurements, particle diagnostics include a Thomson parabola ion analyzer, nuclear activation, and an ion pinhole camera to measure lithium ion beam energy, purity, and transport. With the accelerator at one-half energy, 9.7 TW of power and 350 kJ of energy has been coupled into ions from the LiF source, with 80% ion current efficiency at peak power. Nuclear activation diagnostics indicate that over two-thirds of this ion beam energy was accelerated as singly-ionized lithium. 11 refs., 4 figs.

45610 **(SLAC-PUB—4628) Tuning the Arcs of the SLAC linear collider.** Fieguth, T.; Bambade, P.; Barklow, T.; Brown, K.L.; Bulos, F.; Burke, D.L.; Fischer, G.E.; Haissinski, J.; Hutton, A.; Jung, C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1988. Contract AC03-76SF00515. 4p. (CONF-880695—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012735/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

New experience with the operation of the SLC Arcs is described. Each of these Arcs consists of sequential second-order achromats. Initial measurements showed that the betatron phase advances were systematically offset from the design values. This effect, combined with the abrupt rolls of the achromats needed to follow the local terrain, led to strong cross-plane coupling and to growth of the betatron oscillations. The methods and modifications developed to establish proper operation of the Arcs are described. 10 refs., 4 figs.

45611 **(TRI-PP—88-39) Progress towards H/sup minus/ extraction at TRIUMF.** Laxdal, R.E.; Mackenzie, G.H.; Pearson, J.B.; Stinson, G.; Trelle, R.; Worsham, R.; Zach, M. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1988. 3p. (CONF-880695—37). NTIS (US Sales Only), PC A02. Order Number DE88013270/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A project to prove the feasibility of efficient direct extraction of 100 μA of H/sup {minus}/ ions from the TRIUMF 500 MeV cyclotron is underway. The cw beam would be extracted by one or more electrostatic deflectors and four magnetic channels. The extraction efficiency would be improved by inducing a precessional component to the radius gain per turn by exciting a radial betatron oscillation at ν/sub {tau}/ = 3/2. Further, the energy gain per turn would be doubled at extraction by adding a 150 kV, 92 MHz accelerating cavity. Experiments in situ have demonstrated a 90% extraction efficiency for a pulsed beam with an equivalent cw current of 66. A development program has improved the strength of the deflecting field to 50 kVcm at moderate circulating currents and 32 kV/cm for a time-averaged current of 10 μA. A prototype 65 mT iron-free magnetic channel has been designed. Beam optics calculations of the extraction process are being done in parallel. The design concept of a final extraction system will be described. 9 refs., 6 figs.

4304 Storage Rings

REFER ALSO TO CITATION(S) 45578, 45579

45612 **(CERN—88-01) Proton-antiproton collider. Third John Adams memorial lecture.** Evans, L. (European Organization for Nuclear Research, Geneva (Switzerland)). 11 Mar 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702838/JAW.

Lecture delivered at CERN on 25 November 1987.

The subject of this lecture is the CERN Proton-Antiproton (panti p) Collider, in which John Adams was intimately involved at the design, development, and construction stages. Its history is traced from the original proposal in 1966, to the first panti p collisions in the Super Proton Synchrotron (SPS) in 1981, and to the present time with drastically improved performance. This project led to the discovery of the intermediate vector boson in 1983 and produced one of the most exciting and productive physics periods in CERN's history.

44 INSTRUMENTATION

REFER ALSO TO CITATION(S) 45052

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 45582, 45612, 45706, 45844, 45959, 45964, 46059, 46060

45613 **(AD-A—191619/6/XAB) Program plan and fabrication specification for the supply of experimental RADFET (radiation-sensitive field effect transistor) dosimeters. Periodic report No. 1, June-July 1987.** Holmes-Siedle, A. (Radiation Experiments and Monitors, Oxford (UK)). 27 Jul 1987. 12p. (REM-FM—87-1). NTIS, PC A03/MF A01.

This is a technical planning document outlining test procedures plus a fabrication specification for p-channel metal - oxide - silicon dosimeters, of an experimental type known as RADFETs.

45614 **(BNL—41376) The new AGS H/sup {minus}/ RFQ preinjector.** Alessi, J.G.; Brennan, J.M.; Brodowski, J.; Brown, H.N.; Gough, R.; Kponou, A.; Prelec, K.; Staples, J.; Witkover, R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (CONF-880695—28). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013785/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The AGS will soon be replacing the 750 keV Cockcroft-Walton (C-W) preinjector for the 200 MeV linac by an RFQ preaccelerator. The motivation for this is improved reliability, simpler maintenance, and the convenience of having the source at ground potential. In addition, the fact that there will now be a 35 keV transport section between the source and the RFQ allows us to install a fast chopper at low energy, which will be used for better longitudinal matching of the linac beam to the AGS acceptance ("painting"). At the same time, the upgrade includes improving the instrumentation and controls for the entire low energy beam transport (LEBT) section of the linac. The RFQ, accelerating the H/sup {minus}/ beam from 35 keV to 753 keV, was designed and built at Lawrence Berkeley Laboratory. All components are designed to operate at 10 Hz repetition rate, 500 μS pulse width, although to date tests have been done at the present linac rep-rate of 5 Hz. In the following paper, the source, RFQ, 35 and 753 keV transport lines, beam choppers, and instrumentation will be described, and the performance given. The complete beamline is now operating in a test area, and will be installed in the preinjector area this summer. 6 refs., 6 figs.

45615 **(CERN-EP—87-233) The time projection chamber for heavy-ion collisions: Trends and perspectives.** Sauli, F. (European Organization for Nuclear Research, Geneva (Switzerland)). 23 Dec 1987. 34p. (CONF-8708166—8). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012608/JAW.

From 6. international conference on ultra-relativistic nucleus-nucleus collisions; Nordkirchen, F.R. Germany (24 Aug 1987).

The very large charged-particle multiplicities expected in a high- energy nucleon-nucleon collision, together with the wide range of energy loss by ionization, makes the conception of a tracking detector extremely challenging. One device, the time projection chamber, widely used in particle-physics experimentation, seems very promising in this context. In the present paper, after a brief summary of the operating principles and of the performances achieved in the existing detectors, the expected performances in a high-multiplicity environment are discussed, as well as the recognized problems arising from the large charge densities detected. Some alternative devices that might overcome the recognized limitations of the standard design are also described. 57 refs., 22 figs.

45616 **(DOE/ER/03130—37C) Data acquisition hardware for the D0 MicroVAX farm.** Cutts, D.; Hoftun, J.S.; Johnson, C.R.; Zeller, R.T. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1988. Contract AC02-76ER03130. 8p. (CONF-8803123—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012760/JAW.

From International conference on the impact of digital microelectronics and microprocessors on particle physics; Trieste, Italy (28 Mar 1988).

We describe the MicroVAX-based data acquisition system used by the D0 experiment. We give operational characteristics of the data flow in this system: a "farm" of MicroVAX processors each receiving an event over multiple input dual-port memory channels. We discuss the individual hardware components and their performance at the Fermilab NWA test beam and other sites, as well as some further developments. 1 ref., 1 fig.

45617 **(DOE/ER/10699—T7) [Experimental high energy physics using electromagnetic energy calorimetry].** Marx, M.D.; Rijssenbeek, M. (State Univ. of New York, Albany (USA). Research Foundation). 1988. Contract AC02-80ER10699. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013193/JAW.

In the current year, the major part of the research on this contract was focussed on the construction of the DO detector, testing of production modules (as opposed to prototypes) and in actual coding of tracking software. We are contributing in two areas to the DO Project: the calorimetry, where we are involved in coordination, construction and testing of the central and end calorimeter modules, the test beam program and software development; and the central drift chamber being constructed at Stony Brook and for which we have developed the electronics, test facilities, tracking and general purpose software.

45618 **(GSI—88-08) Proposal for a forward spectrometer at the 4π detector.** Berdermann, E.; Luehning, J.; Lynen, U.; Milkau, U.; Mueller, K.; Sann, H.; Stelzer, H.; Trautmann, W.; Kreutz, P.; Kuehmichel, A.;. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik; Technische Univ. Muenchen (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service Charge de l'Entretien et du Fonctionnement de Saturne; Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Mar 1988. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754153/JAW.

We propose to complement the 4π detector to be installed at the SIS-ESR facility with a forward spectrometer (ALADiN) capable of detecting and identifying nuclear fragments up to the largest masses and momenta expected at SIS. Positioned behind the time-of-flight wall of the 4π detector the spectrometer should subtend an angular range of approximately +-5/sup 0/ in horizontal and at least +-2/sup 0/ in vertical direction and thus cover a sufficiently large part of the forward region. In order to satisfy these requirements and to obtain the necessary resolution in mass and momentum the dipole magnet needs, at least, a gap height of 0.5 m, a horizontal acceptance of 1.5 m and a bending power of 2 Tm. The following sections of this proposal start out with a more detailed presentation of the physics motivation which will concentrate on multifragmentation as a new and hitherto unexplored decay mode of nuclear matter under extreme conditions. The description of the spectrometer divides into three sections containing the description of the magnet and the vacuum system, of the detectors needed to track and to identify the fragments, and of the performance of the spectrometer. (orig./HSI).

45619 **(INIS-BR—1108) Nondestructive method to coat thickness measurements through X-ray fluorescence.** Sanchez, F. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1986. 12p. (In Portuguese). (CONF-8609282—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703209/JAW.

From 1. non destructive testing congress for Latin America and Caribbean; Sao Paulo, Brazil (21 Sep 1986).

It's described a system that permits thickness measurement and composition of Sn-Pb alloys to simultaneous measurement of Au over Ni over any base, beyond convestionals measurements, including flash coats or touch. (C.M.).

45620 **(INIS-BR—1162) Advantages and technical restrictions of X ray tubes with small focus - (microfocus).** (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 10p. (CONF-8708271—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703564/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

The advantages of using amplifying techniques for radiographs and the restrictions from X-ray sources are presented. (E.G.).

45621 (INIS-mf—11001, pp 68-84) **NPP radiation monitoring system with microprocessor-based distributed structure.** Denisov, A.A.; Zhernov, V.S.; Krasheninnikov, I.S.; Matveev, V.V.; Ryzhov, N.V.; Skatkin, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88780026/JAW. (CONF-8205317—Pt.3).

From Radiation safety of nuclear power plants operation conference; Vil'nyus, USSR (1 May 1982).

Radiation monitoring system with microprocessor-based distributed structure is considered. The advantages of application of multichannel basic modules interconnected via data transmission line are emphasized. The distribution of functions between peripheral, basic, and leading modules with computer discussed from tne viewpoint of the NPP centralized radiation safety monitoring. The volume and capasity of the basic module are analuzed with respect to the requirements of the monitoring operativeness. The working regime, data groups organization and the main algorithm for the basic module are presented. 8 refs.; 6 figs.

45622 (INIS-mf—11260, pp 29) **High energy x-ray film response and the intensifying action of metal screens.** Barnea, G.; Ginzburg, A. (National Bureau of Standards, Gaithersburg, MD (USA); Rafael Laboratories, Haifa (Israel)). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45623 (INIS-mf—11260, pp 32) **Silicon PIN photodiode as a direct radiation detector.** Markevich, N.; Gertner, I.; Felsteiner, J. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45624 **(INIS-mf—11782) Use of portable semiconductor detectors in nuclear medicine.** Kuhn, W. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1986. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754335/JAW.

A new biotelemetric system, CdTe semiconductor detectors with portable hard memory, for the registration of time activity curves in particular body regions of patients is introduced. The hard- and software connection of the system to the already present EDV configuration is described. The characteristics of the detectors are studied, theoretically explained and compared to the information given by the producers. By means of the determination of the ortho-iodine hippuric acid clearance (OIH) from the registration of the time activity curves in the chest the first information about the practicability in clinical use as well as the validity of the method are deduced. The detector system proved itself to be susceptible to problems, especially from manipulation of the cable or from movement of the patient. The determination of the OIH clearance from the partial body curve was problematic, because an extrapolation to the whole body based on the specific OIH kinetic in the small, observed tissue section is difficult. The comparison with the camera picture should be carefully evaluated, because this method has in principle the same inadequacies.

45625 (Juel—2169) Study of the magnetic spectrograph BIG KARL on image errors and their causes. Paul, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.)). Dec 1987. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754343/JAW.

The ionoptical aberrations of the QQDDQ spectrograph BIG KARL are measured and analyzed in order to improve resolution and transmission at large acceptance. The entrance phasespace is scanned in a cartesian grid by means of a narrow collimated beam of scattered deuterons. The distortions due to the nonlinear transformation by the system are measured in the detector plane. A model is developed which describes the measured distortions. The model allows to locate nonlinearities in the system responsible for the observed distortions. It gives a good understanding of geometrical nonlinearities up to the fifth order and chromatical nonlinearities up to the third order. To confirm the model, the magnetic field in the quadrupoles is measured including the fringe field region. Furthermore, nonlinearities appearing in ideal magnets are discussed and compared to experimental data.

45626 (ORNL—6463) SCINFUL: A Monte Carlo based computer program to determine a scintillator full energy response to neutron detection for E/sub n/ between 0.1 and 80 MeV: Program development and comparisons of program predictions with experimental data. Dickens, J.K. (Oak Ridge National Lab., TN (USA)). Apr 1988. Contract AC05-84OR21400. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013333/JAW.

This document provides a discussion of the development of the FORTRAN Monte Carlo program SCINFUL (for scintillator full response), a program designed to provide a calculated full response anticipated for either an NE-213 (liquid) scintillator or an NE-110 (solid) scintillator. The program may also be used to compute angle-integrated spectra of charged particles (p, d, t, ^{3}He, and α) following neutron interactions with ^{12}C. Extensive comparisons with a variety of experimental data are given. There is generally overall good agreement (<10% differences) of results from SCINFUL calculations with measured detector responses, i.e., N(E/sub r/) vs E/sub r/ where E/sub r/ is the response pulse height, reproduce measured detector responses with an accuracy which, at least partly, depends upon how well the experimental configuration is known. For E/sub n/ < 16 MeV and for E/sub r/ > 15% of the maximum pulse height response, calculated spectra are within +- 5% of experiment on the average. For E/sub n/ up to 50 MeV similar good agreement is obtained with experiment for E/sub r/ > 30% of maximum response. For E/sub n/ up to 75 MeV the calculated shape of the response agrees with measurements, but the calculations underpredicts the measured response by up to 30%. 65 refs., 64 figs., 3 tabs.

45627 (PB—88-201579/XAB) NBS (National Bureau of Standards) measurement services: calibration of beta-particle radiation instrumentation and sources. Final report. Pruitt, J.S.; Soares, C.G.; Ehrlich, M. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Apr 1988. 77p. (NBS/SP—250/21). NTIS, PC A05/MF A01.

Also available from Supt. of Docs. See also NUREG-CR-4266; Library of Congress catalog card no. 88-600514.

In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle instruments and sources used in radiation-protection dosimetry. Central to this facility are beta particle and nearly monoenergetic electron beams characterized in terms of absorbed-dose rates to water and in terms of pulse-height distributions of beta-particle and electron spectra. The documentation utilizes material previously published or otherwise disseminated by members of the staff of the Ionizing Radiation Division of the Center for Radiation Research (CRR) of the National Bureau of Standards (NBS). After a description of the facility and the procedures, results are given of (1) studies that led to the determination of absorbed-dose rates to water for the NBS beta-particle and nearly monoenergetic electron beams, (2) studies of the influence of source configuration on beta-particle and nearly monoenergetic electron spectra.

45628 (PNL—6620-Vol.1) Personnel neutron dose assessment upgrade: Volume 1, Personnel neutron dosimetry assessment: [Final report]. Hadlock, D.E.; Brackenbush, L.W.; Griffith, R.V.; Hankins, D.E.; Parkhurst, M.A.; Stroud, C.M.; Faust, L.G.; Vallario, E.J. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014088/JAW.

This report provides guidance on the characteristics, use, and calibration criteria for personnel neutron dosimeters. The report is applicable for neutrons with energies ranging from thermal to less than 20 MeV. Background for general neutron dosimetry requirements is provided, as is relevant federal regulations and other standards. The characteristics of personnel neutron dosimeters are discussed, with particular attention paid to passive neutron dosimetry systems. Two of the systems discussed are used at DOE and DOE-contractor facilities (nuclear track emulsion and thermoluminescent-albedo) and another (the combination TLD/TED) was recently developed. Topics discussed in the field applications of these dosimeters include their theory of operation, their processing, readout, and interpretation, and their advantages and disadvantages for field use. The procedures required for occupational neutron dosimetry are discussed, including radiation monitoring and the wearing of dosimeters, their exchange periods, dose equivalent evaluations, and the documenting of neutron exposures. The coverage of dosimeter testing, maintenance, and calibration includes guidance on the selection of calibration sources, the effects of irradiation geometries, lower limits of detectability, fading, frequency of calibration, spectrometry, and quality control. 49 refs., 6 figs., 8 tabs.

45629 (PTB-Ra—20) Activity measurements with portable contamination measuring instruments - comparison measurements with calibrated surface sources. Lauterbach, U. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet). Feb 1988. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754359/JAW.

After the Chernobyl accident, portable contamination measuring instruments were frequently used to quantitatively determine surface-related activities. For this reason, instruments commercially available were checked for their being suitable for such measurement tasks. In collaboration with 18 institutes from the Lower Saxony area, comparison measurements were carried out with such instruments within the scope of which the participants measured the surface-related activities of four surface sources with the radionuclides Pm-147, Co-60, Cl-136 and Sr-90/Y-90 calibrated at the Physikalisch-Technische Bundesanstalt. The report describes the preparation and execution of the comparison and discusses the results obtained with a view to use these instruments for the quantitative in situ determination of the activity.

45630 (RISO-M—2720) Multi-detector powder neutron diffractometer at Risoe National Laboratory. Als-Nielsen, J.; Andersen, N.H.; Broholm, C.; Clausen, K.N.; Lebech, B. (Risoe National Lab., Roskilde (Denmark)). Jun 1988. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754490/JAW.

The report describes a new multi-detector powder neutron diffractometer installed at the DR3 reactor at Risoe. The report gives details of the design criteria and operating instructions in order to ease operation of the instrument by actual and potential users. The individual components (collimators; monochromater, detectors) are described in detail. An example of a study of the oxygen uptake of YBa/sub 2/Cu/sub 3/O/sub 7x/ is given. 13 ills.

45631 (SI—86-16) Performance characteristics of an electromagnetic streamer tube calorimeter. Baumgart, R.; Grupen, C.; Meyer, H.J.; Schaefer, U. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 - Physik). Dec 1986. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754361/JAW.

We have tested an electromagnetic streamer tube calorimeter in an electron beam in the energy range 1-70 GeV. Also the dependence of the response and energy resolution on the particle rate

and magnetic field were investigated. A magnetic field transverse to the streamer tubes has no effect, while a field parallel to the wires deteriorates the energy resolution. (orig.) With 14 figs.

45632 **(SLAC-PUB—4354) Status of {hacek C}erenkov Ring Imaging systems.** Leith, D.W.G.S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1987. Contract AC03-76SF00515. 29p. (CONF-8703128—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012725/JAW.

From International conference on advances in experimental methods for colliding beam physics; Stanford, CA, USA (9 Mar 1987).

Cerenkov Ring Imaging is briefly introduced, and the problems or choices of designing such a counter are discussed. Recent results from the DELPHI and SLD prototype are presented and compared to the expected performances. 13 refs., 33 figs., 2 tabs.

45633 **(UCID—21321) Gain variation with gold coating thickness in pulsed microchannel plate striplines.** Power, G.D. (Lawrence Livermore National Lab., CA (USA)). 1 Mar 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A03. Order Number DE88012447/JAW.

We have built and fielded gated stripline microchannel plate (MCP) detectors since 1984. We have always coated the input (stripline) side with 1 μm of gold, and the output or ground plane side with 1.5 μm of gold. It now appears that this input-side coating thickness is excessive, significantly reducing the gain obtainable from the detector. The strong gain reduction is correlated with slight closing up of the 12-μm openings of the microchannels in the input side of the MCP. 4 refs., 7 figs.

45634 **(UCRL—53861-Vol.1) GRPANL [GRouP ANaLysis]: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra.** Gunnink, R.; Ruhter, W.D.; Niday, J.B. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013793/JAW.

GRPANL (GRouP ANaLysis) is a suite of programs that analyzes and interprets regions of germanium and alpha-particle detector pulse-height spectra. GRPANL is the main peak-fitting program; several other programs are used in conjunction with GRPANL. The program is particularly useful for accurately deconvoluting and interpreting complex clusters of peaks in a spectrum. Other codes do not usually address this level of complexity. GRPANL determines the gamma-ray (x-ray or alpha-ray) energies and intensities of the peaks; it can also identify and measure isotopes in a sample. Versions of the program are installed on Digital Equipment Corporation's (DEC) PDP-11 and VAX computers. An IBM PC version is in the planning stages. 10 refs. 25 figs.

45635 **Method for correcting for isotope burn-in effects in fission neutron dosimeters.** Gold, R.; McElroy, W.N. (to Dept. of Energy, Washington, DC). US Patent 4,744,939. 17 May 1988. Filed date 18 Aug 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for correcting for burn-in in a fissionable neutron dosimeter employing a fissionable isotope (Z, A) is described comprising the steps of: (a) forming two solid state track recorders with fission deposits of the same fissionable materials as the fissionable neutron dosimeter; (b) exposing a first of the two solid state track recorders and the fissionable neutron dosimeter to a first neutron fluence, at least effectively with the same neutron flux-time history with respect to the location of one of them in the fist neutron fluence, whereafter the fissionable neutron dosimeter indicates a total number of fissions F/sub Γ/ which is to be corrected for the burn-in; (c) irradiating the two solid state track recorders with a second neutron fluence; (d) determining the amount of burn-in P/sub Z', A'/ of a higher order isotope (Z' A'), wherein A'>A, in the fission deposit of the first solid state track recorder from the difference between the absolute numbers of fissions per unit volume of the fission deposits in the two solid state track recorders; (e) determining the number of fissions F/sub Z', A'/ of the higher order isotope (Z' A') in the fissionable deposit of the first solid state track recorder during the exposure to the first neutron fluence; and (f) using P/sub Z, A'/ and F/sub Z', A'/ to correct the total number of fissions F/sub Γ/ indicated by the fissionable neutron dosimeter, to provide a value corresponding to the fission rate of the fissionable isotope that is corrected for the fissions due to the burn-in.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

45636 **(AERE-R—13111) Absorption characteristics of a range of optical fibres prior to and after irradiation.** Norris, J.O.W.; Tribble, M.J. (UKAEA Harwell Lab. Materials Development Div.). Apr 1988. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754524/JAW.

The spectra of nine different glass optical fibres and one plastic optical fibre have been measured over the spectral range 300 to 1800 nm, prior to and after irradiating with /sup 60/Co γ-rays. For the majority of fibres the total irradiation dose was several tens of kGy (several Mrad). All of the fibres studied were of the multimode type having a core diameter ≧ 100 μm and could, in principle, be used for data transmission, remote spectroscopy or sensing applications. The majority of fibres have 200 μm diameter cores which are compatible with the Harwell 6000 series optical modules. The various fibres were found to have quite different transmission characteristics in their unirradiated state. This combined with variations in their other optical properties means that no single fibre is best for all applications. After irradiation the ultra-violet absorption edge moved towards longer wavelengths for all fibres, but by varying degrees. In many fibres a new absorption peak around 600-630 nm was observed. The amount of radiation induced attenuation was found to decrease with increasing wavelength beyond 700 nm for all fibres studied. Three glass fibres were shown to have particularly high levels of attenuation after irradiation. The report also contains background information on the different causes of attenuation in unirradiated optical fibres.

45637 **(SAND—88-1870C) Computer simulation of ionizing radiation burnout in power MOSFETs.** Keshavarz, A.A.; Fischer, T.A.; Dawes, W.R. Jr.; Hawkins, C.F. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880730—6). NTIS, PC A02. Order Number DE88012392/JAW.

From 25. annual conference on nuclear and space radiation effects; Portland, OR, USA (12 Jul 1988).

The transient response of a power MOSFET device to ionizing radiation was examined using the BAMBI device simulator. The radiation rate threshold for burnout was determined for several different cases. The burnout mechanism was attributed to current-induced avalanche. The effects of the applied drain-source voltage and the base width of the parasitic bipolar device on the threshold level were modeled. It was found that the radiation rate threshold is lower at higher drain-source voltages or narrower bases. 8 refs., 17 figs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 44562, 44594, 44614, 45284, 45307, 45447, 45553, 45557, 45605, 45690

45638 **(AERE-M—3660) Chemical sensors and gas sensors for process control in biotechnology.** Williams, D.E. (UKAEA Harwell Lab. Materials Development Div.). Apr 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754523/JAW.

This paper is concerned with the possibilities for chemical measurement of the progress of biotechnological processes which are offered by devices already developed for other demanding applications. It considers the potential use of ultrasonic instrumentation originally developed for the nuclear industry, gas measurement methods from the fields of environmental monitoring and combustion control, nuclear instruments developed for the oil, mining and chemical industries, robotic systems and advanced control techniques.

45639 **(INIS-BR—1159) Utilization of radiation in non destructive tests.** Lopes, R.T.; Jesus, E.F.O. de; Junqueira, M.M.; Matos, J.A. de; Castello Branco, L.M.; Barros Junior, J.D.; Borges, J.C. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 14p. (CONF-8708271—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703562/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

The Nuclear Instrumentation Laboratory from COPPE/UFRJ has been developed techniques for using nuclear radiations to obtain images for non-destructive materials testing and medicine. With this objective, some prototypes of transmission computerized tomography systems using parallel beans and fan beans, with computer automation, including the mathematical process of image reprocessing and presentation in videos or printers are constructed.

45640 **(PB—88-191523/XAB) NMR spectrometry; evaluation of a 1.2-T resistive magnet spectrometer.** Mehier, H.; Foray, J. (Laboratoire de Spectrochimie Infrarouge et Raman, Villeneuve d'Ascq (France)). 1988. 94p. (In French). NTIS, PC E05/MF E05.

NMR imagery makes it possible to study other nuclei besides hydrogen, in particular phosphorus 31 or carbon 13, which are rich sources of biological information. The first part of the report, which is rather bibliographical in nature, recalls the bases of NMR and details the method called NMR in-vivo spectrometry. The second part is a presentation of the NMR spectrometry laboratory of Chamonix (France). It reviews in detail the development of the electromagnet and MNR signal sensors. A chapter is devoted to software functions: spectrometer control, and signal processing. The last chapter presents the spectra obtained with phosphorus and sodium as well as the proton spectrum.

45641 **(PB—88-201595/XAB) NBS (National Bureau of Standards) measurement services: the NBS Photodetector Spectral-Response-Calibration Transfer Program. Final report.** Zalewski, E.F. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Mar 1988. 66p. (NBS/SP—250/17). NTIS, PC A04/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card no. 88-600509.

A silicon-photodiode-based radiometer is supplied to transfer the calibration of absolute spectral response in units of A/W (Amperes/Watt) and A sq cm/W in the 250- to 1064-nm region of the spectrum. The radiometer is also characterized for linearity over the four-decade range of the amplifier gain settings. Also included with the radiometer are components and a procedure for measurement-error diagnosis. The methods for obtaining and using this calibrated radiometer are described, as well as the calibration and characterization procedures used at NBS.

45642 **HgTe-CdTe superlattices grown by photo-MOCVD.** Ahlgren, W.L.; James, J.B.; Ruth, R.P.; Patten, E.A.; Staudenmann, J.L. pp 405-415 of Materials for infrared detectors and sources; Proceedings of the Symposium, Boston, MA, Dec. 1-5, 1986. Farrow, R.F.C.; Schetzina, J.F.; Cheung, J.T. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612152—).

From Materials for infrared detectors and sources; Boston, MA, USA (1 Dec 1986).

HgTe-CdTe superlattices were grown by photoassisted MOCVD, with a substrate temperature of 182 C and a growth time of about 10 hours. X-ray diffraction patterns revealed satellite peaks up to third order. The superlattice structure has HgTe layers about 20 percent thicker than the target values. A grid-like array of dislocations at the substrate-epilayer interface was noted. The presence of deficiencies in the superlattice growths, including a low growth rate, nonuniform layers, high dislocation density, and high n-type carrier concentration, suggests the presence of donor impurities in the material. 19 references.

45643 **Analytical chemistry instrumentation.** Laing, W.R. Chelsea, MI; Lewis Publishers (1986). 372p. Lewis Publishers, 121 South Main St., P.O. Drawer 519, Chelsea, MI 48118.

In nine sections, 48 chapters cover 1) analytical chemistry and the environment 2) environmental radiochemistry 3) automated instrumentation 4) advances in analytical mass spectrometry 5) fourier transform spectroscopy 6) analytical chemistry of plutonium 7) nuclear analytical chemistry 8) chemometrics and 9) nuclear fuel technology.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 44750, 45573

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 45647

45644 **(CONF-870868—1) Two-phase steady detonation analysis.** Powers, J.M.; Stewart, D.S.; Krier, H. (Illinois Univ., Urbana (USA)). 1987. Contract W-7405-ENG-36. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012957/JAW.

From 11. international colloquium on dynamics of explosions and reactive systems; Warsaw, Poland (3 Aug 1987).

Steady solutions to a set of two-phase reactive flow model equations are studied to test the hypothesis that observed deviations from Chapman-Jouguet (CJ) detonation states in porous solid propellants are manifestations of the two-phase nature of the flow. Shock jump relations are presented. A simple expression for a minimum detonation wave speed analogous to a CJ detonation for a single phase is given. The analogous CJ point is a sonic point. In the appropriate limit the minimum detonation velocity varies linearly with initial bulk density, and the corresponding detonation pressure varies with the square of initial bulk density. Non-ideal gas effects play an important role in determining CJ conditions. The effect of reaction zone structure is studied to determine its effect on detonation end states. 19 refs., 7 figs., 1 tab.

45645 **(MLM—3504(OP)) Friction and impact sensitivities of explosives: A comparative study.** Wang, Pu Sen; Hall, G.F. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1988. Contract AC04-76DP00053. 7p. (CONF-880473—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012864/JAW.

From American Defense Preparedness Association Compatibility symposium; New Orleans, LA, USA (18 Apr 1988).

Impact and friction sensitivities of explosives were tested by the "one-shot" method. The Bruceton statistical method was used to derive 50% initiation levels. The materials tested include: PETN, HMX, CP, barium styphnate, TATB, RX26BB, RX26BH, PYX, BTF and various types of plastic bonded explosives (PBX). Some samples were investigated for aging effects, physical variables, and the effect of manufacturing parameters on these sensitivities. The results proved to have comparative values. CP and barium styphnate were found to be the most sensitive among the samples tested, while TATB was found to be relatively insensitive. 9 refs., 3 tabs.

45646 **The shock dynamics of stable multidimensional detonation.** Stewart, D.S.; Bdzil, J.B. (Dept. of Theoretical and Applied Mechanics, Univ. of Illinois at Urbana-Champaign, Urbana, IL (US)). *Combustion and Flame;* **72**: No. 3, 311-324(Jun 1988).

The paper develops a description for the propagation of an unsupported, unsteady, multidimensional detonation wave for an explosive with a fully resolved reaction zone and a polytropic equation of state. The main features of the detonation are determined once the leading shock surface is known. The principal result is that the detonation velocity in the direction along the normal to the shock is the Chapman-Jouguet velocity plus a correction that is a

function of the local total curvature of the shock. A specific example of unsteady propagation is discussed and the stability of a two-dimensional steady solution is examined.

4502 Nuclear

REFER ALSO TO CITATION(S) 45331, 45334

45647 **(LA—11318-MS) The role of the DOE weapons laboratories in a changing national security environment: CNSS papers No. 8, April 1988.** Hecker, S.S. (Los Alamos National Lab., NM (USA). Center for National Security Studies). 1988. Contract W-7405-ENG-36. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011822/JAW.

The contributions of the Department of Energy (DOE) nuclear weapons laboratories to the nation's security are reviewed in testimony before the Subcommittee on Procurement and Military Nuclear Systems of the House Armed Services Committee. Also presented are contributions that technology will make in maintaining the strategic balance through deterrence, treaty verification, and a sound nuclear weapons complex as the nation prepares for significant arms control initiatives. The DOE nuclear weapons laboratories can contribute to the broader context of national security, one that recognizes that military strength can be maintained over the long term only if it is built upon the foundations of economic strength and energy security. 9 refs.

45648 **(SAND—88-0043C) Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?.** Vittitoe, C.N. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-880852—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008795/JAW.

From US-Japan seminar on electromagnetic interference in highly advanced social systems; Honolulu, HI, USA (1 Aug 1988).

Studies of electromagnetic pulse (EMP) effects on civilian and military systems predict results ranging from severe destruction to no damage. Convincing analyses that support either extreme are rare. The Hawaiian streetlight incident associated with Starfish nuclear burst is the most widely quoted observed damage. We review the streelight characteristics and estimate the coupling between the Starfish EMP and a particular streelight circuit identified as one of the few that failed. Evidence indicates that the damage was EMP-generated. The main contributing factors were the azimuthal angle of the circuit relative to the direction of EMP propagation, and the rapid rise of the EMP signal. The azimuthal angle provided coherent buildup of voltage as the EMP swept across the transmission line. The rapid rise allowed substantial excitation before the canceling effects of ground reflections limited the signals. Resulting voltage were beyond the threshold for causing the observed fuse damage and are consistent with this damage occurring in only some do the strings in the systems. 15 refs., 10 figs., 3 tabs.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

45649 (CONF-8708252—, pp 46, Paper 2) **Historical sunshine data in the United States.** Young, P.J.; Quinlan, F.T.; Karl, T.R. (National Oceanic and Atmospheric Administration, Asheville, NC (USA)). Jun 1988. NTIS, PC A09/MF A01. Order Number DE88011540/JAW. Contract AC05-84OR21400.

From 2. science team meeting of the United States DOE and Peoples Republic of China academia; Harpers Ferry, WV, USA (26 Aug 1987).

This document contains a complete listing of the 240 stations and a sample listings of the total monthly and annual sunshine measurements, maximum possible monthly and annual sunshine measurements, and the percentages of monthly and annual sunshine (measured/maximum possible).

45650 **(NP—8770246) Box model describing the dispersion of heavy gases after accidents and its verification by experiments.** Dunst, M.; Fischer-Bruns, I.; Luksch, U. (Hamburg Univ. (Germany, F.R.). Meteorologisches Inst.; Umweltbundesamt, Berlin (Germany, F.R.)). 15 May 1987. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770246/JAW.

This investigation strived for the aim to estimate with sufficient approximation the risks which are run with respect to the dispersion of heavy gases, when accidents under certain meteorological conditions occur. With regards to the contents some different aspects have been considered: a. Development of a new energy-conserving box model for the heavy gas diffusion dominating by gravity (Phase I). b. Consideration fo the thermal effects in heavy gas dispersion. c. Modelling the transition from phase I (defined above) to the phase of more tracer-dispersion, using a numerical diffusion model for the diffuse phase. d. Comparison with other models. Especially for large volums of heavy gases, being emitted during real accidents very often, the new Box model yields reliable distributions of the concentration. Furtheron it could be clarified, in what cases the thermal effects should be accounted for. Finally the combination of the new Box model and the numerical diffusion model is an efficient tool, to simulate the whole dispersion process approximately. (orig.) With 37 refs., 8 tabs., 41 figs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 44967, 44983, 45264, 45439, 45765, 45817, 45823, 45825, 45847, 45855, 45856, 45865, 45867, 45868, 45869, 45870, 45871

45651 **(AD-A—192170/9/XAB) Test and evaluation of 18,000 btuh/100 cfm integrated chemical filter and environmental control equipment (ICE) unit. Final report, 19 November 1985-30 September 1986.** Sherfy, R.B.; Tanner, J.D. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 30 Sep 1986. 88p. (VSE/ASG—0190-86/17RD). NTIS, PC A05/MF A01.

A prototype 18K/100 ICE Unit was tested, modified, and evaluated and has a Level 1 drawing package updated according to task-order requirements. The results of this effort yielded seven pretest and six post-test hardware modifications, a proposed operator and maintenance manual, and 34 recommended changes to be incorporated into a production ICE unit. If adopted, these 34 changes will give an estimated savings of 22 pounds, 0.2 cubic feet, and $4,000.00 per unit. VSE Corporation recommended that the changes be adopted and the proposed manual be fully developed for future use.

45652 **(AD-A—192435/6/XAB) Removal of volatile organics from humidified air streams by absorption. Final report, July 1985-March 1987.** Coutant, R.W.; Zwick, T.; Kim, B.C. (Battelle Columbus Labs., OH (USA)). Dec 1987. 98p. NTIS, PC A05/MF A01.

The Air Force frequently relies on air-stripping technologies to remove organic chemicals from ground waters contaminated from fuel and solvent spills. Although air stripping is extremely efficient at removing contaminants from the groundwater, these contaminants are only transferred into the air and in several states, air pollution controls are also required. Activated-carbon beds are one potential emissions control under study. The objective of this study was to determine the effects of contaminant concentration, humidity, and chemical competition on the sorption performance of activated carbons. Based on laboratory results, a preliminary cost comparison was made for heated and unheated carbon beds. Volatile organics of interest included benzene, ethyl benzene, toluene, xylenes. trichloroethylene, and 1,1-dichloroethylene.

45653 **(CONF-880857—1) Parameterizations of microphysical processes in clouds for application in models of regional atmospheric deposition.** Lee, In Young. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010017/JAW.

From International cloud physics conference; Bad Homburg, F.R. Germany (15 Aug 1988).

This report reviews cloud physics parameterizations to examine the theoretical basis and evaluate the applicability to regional models, and to obtain more efficient, improved parameterizations by optimization upon results of a detailed cloud model that incorporates treatments of microphysical processes and cloud dynamics too detailed for routine use in a regional model. 5 refs., 7 figs., 1 tab.

45654 (CONF-8708252—, pp 26, Paper 1) **Description of IAP two-level atmospheric general circulation model.** Zhang, X.; Liang, X. (Institute of Atmospheric Sciences, Beijing (China)). Jun 1988. NTIS, PC A09/MF A01. Order Number DE88011540/JAW. Contract FG02-85ER60314.

From 2. science team meeting of the United States DOE and Peoples Republic of China academia; Harpers Ferry, WV, USA (26 Aug 1987).

In the early 1980s a group of Chinese scientists under the direction of Professor Zeng Qung-Cun of the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences, undertook the development of numerical models for use in climate simulation. The program's first product, a two-level atmospheric general circulation model (IAP 2-L AGCM), was presented in mid 1986. This report, part of a more detailed documentation currently in preparation, details this current IAP AGCM from the viewpoint of numerical computation.

45655 (CONF-8708252—, pp 38, Paper 3) **United States Historical Climatology Network (HCN) serial temperature and precipitation data.** Quinlan, F.T.; Karl, T.R.; Williams, C.N. Jr. (National Oceanic and Atmospheric Administration, Asheville, NC (USA)). Jun 1988. NTIS, PC A09/MF A01. Order Number DE88011540/JAW. Contract AC05-84OR21400.

From 2. science team meeting of the United States DOE and Peoples Republic of China academia; Harpers Ferry, WV, USA (26 Aug 1987).

In recent years, numerous studies have been conducted that focused on the problems of climate change and potential climatic impacts of increased concentrations of greenhouse gases. To accurately assess climate change resulting from human activities, it is imperative that an accurate, unbiased, modern historical climate record exist. Unfortunately, many of the data bases used in past studies are not believed to be free of bias and error. Because of this belief, the Carbon Dioxide Research Division of the US Department of Energy and the National Climatic Data Center of the National Oceanic and Atmospheric Administration (NOAA) established a network of approximately 1219 stations in the contiguous US for the specific purpose of compiling a data set suitable for the detection and monitoring of climate change over the past two centuries. This network, known as the historical climatology network (HCN), and the resulting data set are discussed and documented.

45656 **(CRIE-U—86049) Studies on the combined effect of low level air pollutants on plants 3. Effect of SO_2 and/or O_3 on the leaf constituent of bean.** Sato, Shusei; Ogawa, Tadashi; Fujiwara, Takashi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Aug 1987. 16p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753863/JAW.

The effect of SO_2 and O_3 gases on the content and composition of leaf constituent of bean was examined. Bean was exposed to SO_2 and O_3, individually and in combination, for 4 weeks, and the result was compared and studied with that obtained from controlled environment greenhouse. Single treatent of low level SO_2 or SO_3 showed no significant effect. Combined treatment of SO_2 and O_3 caused significant reduction in the protein content, while nucleic acid (RNA) content was not affected. Analysis of chlorophyll and protein contents of leaves showed that the reduction of growth caused by SO_2 + O_3 treatment can be attributed to a premature senescence in lower leaves. (3 figs, 2 tabs, 17 refs)

45657 **(DOE/ER/60444—H1) The use of statistical climate-crop models for simulating yield to project the impacts of CO_2 induced climate change.** Decker, W.L.; Achutuni, R. (Missouri Univ., Columbia (USA). Cooperative Inst. for Applied Meteorology). Jul 1988. Contract FG02-86ER60444. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012852/JAW.

This report describes the use of mathematical models to forecast the effects of increased CO_2 concentration in the atmosphere. These models were created to predict crop yields under different climatic conditions. The authors have adapted them to consider climatic changes caused by the "greenhouse effect." Principal climatic variables include monthly precipitation and temperature range. 40 refs., 5 figs., 4 tabs. (TEM)

45658 **(IVL-B—829) Compilation of four years results of monitored air pollutions at Roervik, Onsala.** Loevblad, G.; Andreasson, K.; Svanberg, P.A. (Swedish Environmental Research Inst., Goeteborg). Jun 1986. 20p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88753696/JAW.

Results from four years monitoring of air pollutants at Roervik (45 km S of Gothenburg) are compiled in this report as means and extremes and also presented in diagram correlated with winddirection. (authors).

45659 **(NILU-OR—48/85) Population exposure to air poiiution in Oslo, in the year 2000.** Groenskei, K.E.; Gran, F. (Norsk Inst. for Luftforskning, Lillestroem). Feb 1985. 33p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753707/JAW.

The report deals with population exposure to air pollution in Oslo (Norway) in the year 2000. The population exposure is clarified by dispersion calculations. Average concentration in winter and episode concentrations are claculated in each square kilometer. In order to describe exposure to concentrations above air quality standards for NO/sub 2/ because of emission from car traffic it will be necessary to perform detailed calculation close to streets with high traffic. 16 drawings, 4 tables.

45660 **(NLVF/S—642) Environmental impacts from the combustion of biomass. Final report.** Benestad, C. (Norges Landbruksvitenskapelige Forskningsraad, Oslo). Jan 1986. 13p. (In Norwegian). (SI—820135-6). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753709/JAW.

The report concerns the project on environmental impacts from the combustion of biomass, and aims at the mapping of impacts from the utilization of biomass for energy purposes. the emissions from the combustion cause hazard to health and environment both on short- and long terms. A qualitative - and quantitative mapping of the emissions are given in order to evaluate the environmental consequences from the various impacts of biomass utilization for energy purposes. The results can be used as fundamentals for the optimization of the various combustion processes. New approaches are briefly discussed. 1 table, 26 references.

45661 **(NP—8770235) Analysis of airborne dust emitters in West Berlin.** Freise, R.; Israel, G.W.; Hoer, B.; Hegner, T.; Liebsch, U.; Schmidt, A.; Shen, J.; Suritsch, N. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Technischen Umweltschutz). Mar 1987. 206p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770235/JAW.

Using the available emission data, the sources of airborne dust in the different parts of West Berlin are investigated. Yearly averaged isolines of metal dust concentrations (Pb, Cd, As, Hg, Zn, Fe, Ni, Cr, V, Be, Cu, Co, Tl, Sb) were recorded for all wind directions. Pb was used as tracer for assessing the contribution of the traffic sector. Other constituents were determined by a regression analysis. The theory and application of receptor models are discussed, and the Cluster Transformation Factor Analysis is developed, whose application helps to determine emission sources. The findings are used for drawing up a specific programme for analyzing the sources of fly dust emissions and dust constituents. (RB)

45662 **(PB—88-197942/XAB) Dispersion modelling of industrial nitrogen oxides at Avonmouth and Teesside, with reference to siting of EC NO_2 Directive monitors.** Timmis, R.J. (Warren Spring Lab., Stevenage (UK)). 1987. 46p. (LR—594(AP)M). NTIS, PC E05/MF E05.

Ground-level concentrations of nitrogen oxides due to selected major industrial plant were modelled at Avonmouth and Teesside, as part of a study to select monitoring sites under the EC NO_2 Directive. The maximum annual-average concentrations due to emissions from the nitric acid plant at Avonmouth were predicted to occur in an area of farmland situated 1-2 km northeast of the largest plant. A similar calculation for two large chemical works at Teesside indicated that concentration maxima occur near residential communities situated to the north and east of the works. The predicted concentrations of nitrogen oxides in each industrial area were contoured, and have been used to plan a diffusion-tube monitoring study in the areas of maximum predicted concentration.

45663 **(PB—88-198478/XAB) Impact of the reduction in the lead content of petrol on airborne-lead concentrations in the United Kingdom from January 1986.** McInnes, G. (Warren Spring Lab., Stevenage (UK)). 1987. 35p. (LR—633(AP)M). NTIS, PC E05/MF E05.

Lead in petrol is the major source of airborne lead in the United Kingdom. On 1 January 1986 the maximum permissible lead content of petrol was reduced from 0.4 to 0.15 grams per litre. This report assesses the results available from 20 airborne-lead monitoring stations in rural, urban, and kerbside locations across the UK over the period January 1984 to December 1986, in order to quantify the effect of this reduction on airborne lead concentrations in 1986. Results for 1986 were compared with those available for October 1984 to September 1985 i.e., the last 12-month period prior to the introduction of deliveries of petrol with reduced lead content. Emissions of lead from motor vehicles were estimated to be 7300 tons in 1984/5 and reduced to 2900 tons in 1986. Analysis of the airborne lead concentrations between these two periods shows reductions of between 24 and 74% with an average reduction over all sites of 53%. This reduction indicates that lead from vehicles contributes about 88% of airborne lead concentrations prior to the introduction of low-leaded fuel.

45664 **(PB—88-198486/XAB) Fletton brickworks ambient air fluoride study: technical assessment.** Irwin, J.G. (Warren Spring Lab., Stevenage (UK)). 1987. 19p. (LR—628(AP)M). NTIS, PC E04/MF E04.

A two-year study conducted by Aston University has produced a valuable data set of daily airborne fluoride concentrations in the surroundings of the Bedfordshire brickfields. The sampling methodology was subjected to a number of independent checks to ensure the quality of the data. Airborne fluoride concentrations in the Marston Vale were mapped and the relationships with brick production, meteorology, and fluoride concentration in herbage examined. There is evidence of a reduction in concentrations in recent years. Concentrations during the study met air quality standards adopted by countries within the European Community on both daily and longer time scales.

45665 **(PB—88-198551/XAB) Construction and operation of a 10 cfm (cubic feet per minute) sampling system with a 10:1 dilution ratio for measuring condensable emissions. Final report.** Steele, W.J.; Williamson, A.D.; McCain, J.D. (Southern Research Inst., Birmingham, AL (USA)). Apr 1988. 28p. NTIS, PC A03/MF A01.

The report describes a transportable sampling apparatus designed to sample incineration sources at municipal and hazardous-waste disposal facilities, and to provide non-contaminated samples of condensable materials. The sample gas, at a flow rate of 10 cubic feet per minute (c f/m), passes through a modified Source Assessment Sampling System (SASS) cyclone and is then diluted with clean air at 100 cf/m by a novel, perforated cone assembly. Rapid uniform dilution takes place through the vigorous mixing of the sample and clean air streams in the dilution chamber. The resultant gas, cooled to about atmospheric conditions, is passed through a mixing section that provides a residence time of about 3 seconds. The resulting aerosol particles are collected on a Teflon-coated glass-fiber filter. These solids, along with those collected in the cyclone, are subsequently provided for chemical and biological assay analysis.

45666 **(PB—88-198817/XAB) Survey of gaseous air pollutants at selected UK sites: XIX. Data digest for Stevenage, Hertfordshire, 1984.** Broughton, G.F.J.; Bower, J.S.; Drury, V.; Lilley, K.; Powell, K. (Warren Spring Lab., Stevenage (UK)). 1987. 60p. (LR—604(AP)M). NTIS, PC E06/MF E06.

See also Part 18, PB—88-198809.

Ambient air-quality measurements of six gaseous pollutants continued during 1984 at Stevenage, Hertfordshire sponsored by the Department of the Environment. These data are presented here in the form of frequency distributions, averages, and other parameters for winter, summer, annual, and monthly periods. Time-series graphs of pollutant concentrations for 1984 and of the historical data base between April 1977 and December 1984 are also included.

45667 **(PB—88-198825/XAB) Survey of gaseous air pollutants at selected UK sites: XX. Data digest for Central London Laboratory, 1984.** Broughton, G.F.J.; Bower, J.; Drury, V.J.; Lilley, K.; Powell, K. (Warren Spring Lab., Stevenage (UK)). 1987. 63p. (LR—605(AP)M). NTIS, PC E06/MF E06.

See also Part 19, PB—88-198817.

Ambient air-quality measurements of six gaseous pollutants plus black smoke and particulate lead continued during 1984 at the Central London Laboratory. The data are presented here in the form of frequency distributions, averages, and other parameters for winter, summer, annual and monthly periods. Time-series graphs of pollutant concentrations for 1984 and of the historical data base between July 1972 and December 1984 are also included.

45668 **(PB—88-198833/XAB) Survey of gaseous air pollutants at selected UK sites: XXI. Data digest for Cromwell Road, London, 1984.** Broughton, G.F.J.; Bower, J.; Drury, V.J.; Lilley, K.; Powell, K. (Warren Spring Lab., Stevenage (UK)). 1987. 64p. (LR—606(AP)M). NTIS, PC E06/MF E06.

See also Part 20, PB—88-198825.

Ambient air-quality measurements of four gaseous pollutants plus black smoke and particulate lead continued during 1984 at the Cromwell Road kerbside site sponsored by the Department of the Environment. These data are presented here in the form of frequency distributions, averages, and other parameters for winter, summer, annual and monthly periods. Time-series graphs of pollutant concentrations for 1984 and of the historical data base between March 1973 and December 1984 are also included.

45669 **(PB—88-200415/XAB) Analysis of nitrogen dioxide episodes in London. Report for March-December 1983.** Simpson, D. (Warren Spring Lab., Stevenage (UK)). 1987. 71p. NTIS, PC E06/MF E06.

This report examines periods of high nitrogen dioxide concentrations measured at two Warren Spring Laboratory (WSL) sites in central London during the period July 1976-March 1983. The temporal variation in occurrence of episodes is illustrated and the associated meteorological conditions are analysed. An attempt was made to identify the relative contribution of various sources and, in particular, comparison was made between the contributions from vehicular and stationary sources. Modelling of one two-day episode was undertaken to test the applicability of Gaussian models to concentrations of nitrogen oxides, and to give further information on the breakdown between different source contributions.

45670 **(PB—88-201132/XAB) Sampling and determination of gas-phase hydrogen peroxide following removal of ozone by gas-phase reaction with nitric oxide.** Tanner, R.L.; Markovits, G.Y.; Ferreri, E.M.; Kelly, T.J. (Brookhaven National Lab., Upton, NY (USA). Environmental Chemistry Div.). 1986. 11p. NTIS, PC A03/MF A01.

Pub. in Analytical Chemistry, Vol. 58, No. 8, 1857-1865(Jul 1986).

A method for determination of hydrogen peroxide in the ambient atmosphere is described, using impinger or diffusion scrubber collection of hydrogen peroxide with aqueous-phase analysis by an enzyme-catalyzed fluorescence technique. Interference from ozone at ambient levels is removed by gas-phase titration with excess nitric oxide. The impinger and diffusion scrubber collection techniques are shown to give equivalent results for atmospheric gas-phase hydrogen peroxide with limits of detection of 0.1 ppbv for approximately 60-min and 10-min sampling times, respectively.

45671 **(PB—88-201199/XAB) Kinetics and selectivity of deep catalytic oxidation of n-hexane and benzene.** Gangwal, S.K.; Mullins, M.E.; Spivey, J.J.; Caffrey, P.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). 1988. 19p. (EPA—600/J-88/008). NTIS, PC A03/MF A01.

Pub. in Applied Catalysis, Vol. 36, 231-247(1988).

Deep (complete) catalytic combustion (oxidation) of volatile organic compounds (VOCs) is emerging as an important emission-control technique. A fundamental study was carried out for low-temperature deep oxidation of n-hexane and benzene over a 0.1% Pt, 3% Ni/gamma-Al_2O_3 catalyst. These VOCs were subjected to oxidation as single components and as a binary mixture at temperatures ranging from 160 to 360°C, n-hexane oxidation was significantly inhibited in the mixtures. An approach based on the Mars-Van Krevelen rate model was used to explain the results. Kinetic parameters were developed for the individual VOCs based on single component differential reactor data. These kinetic parameters were then incorporated into a proposed multicomponent Mars-Van Krevelen rate model to predict the experimental conversions in the binary mixture. The model was found to be reasonably successful in predicting the conversion of benzene and n-hexane in their binary mixture.

45672 **(PB—88-201215/XAB) Composite receptor method applied to Philadelphia aerosol.** Dzubay, T.G.; Stevens, R.K.; Gordon, G.E.; Olmez, I.; Sheffield, A.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1988. 10p. (EPA—600/J-88/007). NTIS, PC A02/MF A01.

Pub. in Environmental Science and Technology, Vol. 22, No. 1, 46-52(Jan 1988).

Particles were collected in dichotomous samplers at three sites in the Philadelphia area during summer, 1982, and analyzed by x-ray fluorescence, instrumental neutron activation, pyrolysis, and ion chromatography. An intermethod comparison showed that fine-fraction results agreed within measurement error for S, Ca, Mn, Fe, Zn and Sb. A composite of chemical mass balance, multiple linear regression, and stratification by wind direction was used to apportion mass into ten categories. Primary emissions from residual-oil combustion, catalytic crackers, an antimony roaster, and municipal incinerators contributed less than 10% of PM-10. The portions of average PM-10 attributed to crustal matter and vehicle exhaust were 17 + or - 2 and 6 + or - 2, respectively. That attributed to sulfate plus related water and ions was 50 to 55%. Wind-stratified data indicated that 80 + or - 20% of the sulfate was from a regional background. Multiple linear regression of S vs tracers Se and either V or Ni indicated that 72 + or - 8 and 16 + or - 5% could be attributed to coal- and residual oil-fired power plants, respectively.

45673 **(PB—88-202387/XAB) Dispersion model for elevated dense-gas-jet chemical releases. Volume 1. Documentation.** Havens, J.; Spicer, T. (Arkansas Univ., Fayetteville (USA)). Apr 1988. 82p. NTIS, PC A05/MF A01.

For system on diskette, see PB—88-202379. See also Volume 2, PB—88-202395.

This document is the first of two volumes describing the development and use of a computer program designed to model the dispersion of heavier-than-air gases emitted into the atmosphere with significant velocity through elevated ports. The program incorporates the sequential execution of two models. The first one (Ooms) calculates the trajectory and dispersion of the gas plume as it falls to the ground. The second (DEGADIS) calculates the downwind dispersion after the plume touches ground. The first volume discusses the development of both models and establishes the mathematical framework for the calculations. In addition, the trajectory portion of the model is evaluated in reference to wind-tunnel data.

45674 **(PB—88-202981/XAB) Polyvinyl chloride meat-wrapping film study. Final report.** Vandervort, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1988. 9p. NTIS, PC A02/MF A01.

As a result of worker complaints in the Baltimore, Maryland area, potential health hazards associated with the use of polyvinyl-chloride film for wrapping meat were reviewed. Fumes generated during the meat-wrapping process were causing concern among the workers as they experienced respiratory irritation and distress. It appeared that only some of the meat wrappers experienced difficulty, only some of the rolls of film-produced irritations in the affected workers, and affected workers had prior histories of respiratory difficulties. Fumes were generated during hot-wire film cutting. The amount of fume generated depended significantly on the care taken during the operation. If the dispensing machines were improperly adjusted, large amounts of fumes could be obtained during the cutting process. The author concludes that the amounts of these chemicals released during this operation does not constitute a health hazard to the employees. It may be necessary, however, to remove persons with prior respiratory irritation from this particular job location.

45675 **(PB—88-203690/XAB) Health-hazard evaluation report HETA-84-166-1540, US Environmental Protection Agency, Lackawanna Refuse Site, Old Forge, Pennsylvania.** Costello, R.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1984. 33p. (HETA—84-166-1540). NTIS, PC A03/MF A01.

An investigation was made at the Lackawanna Refuse Site, Old Forge, Pennsylvania, of possible employee exposure to industrial and hazardous waste disposed of at this site. On-site analyses were performed on debris, and 12 personal air samples and 82 fixed location samples were taken. Less than 40% of the airborne dust particles were respirable. As no airborne contaminant was noted in concentration of significance, the author concludes that this hazard does not exist at this site. However, heat stress induced by protective clothing was not controlled in accordance with federal regulations and was deemed to be a health threat to workers. The author recommends measures to be taken to prevent heat stress.

45676 **(PB—88-203807/XAB) Health-hazard evaluation report HETA-87-262-1852, Artistic Awards, Colorado Springs, Colorado.** Lee, S.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 12p. (HETA—87-262-1852). NTIS, PC A03/MF A01.

In response to a request from Artistic Awards Co., Colorado Springs, Colorado, a study was made of possible exposure to lead during lead-medallion production. An elevated blood-lead level had been found in one worker with symptoms of weakness and fatigue. Personal breathing-zone air samples obtained from the areas of casting and engraving showed levels of 7.3 to 8.0 micrograms/cubic meter (microg/m^3). Excessive levels of lead in the air resulted from a lack of local exhaust ventilation in this area. Workers in this room wore half-face respirators; however, the respirator which was worn by the worker who had the elevated blood lead level failed to pass a fit test. After improvements had been made, the ventilation system was observed to be very effective. Lead exposures during buffing and grinding operations had been reduced to below the limit of detection, 6microg/m^3. The author concludes that one worker was overexposed to lead due to a poorly fitted respirator, and possibly to ingestion of lead deposited on food or drinks.

45677 **(PB—88-204151/XAB) PCBs (polychlorinated biphenyls), PCDDs (polychlorinated dibenzo-p-dioxins) and PCDFs (polychlorinated dibenzofurans): prevention and control of accidental and environmental exposure. Environmental health series.** (World Health Organization, Copenhagen (Denmark). Regional Office for Europe). 1987. 240p. (EH—23). NTIS, PC A11/MF A01.

See also PB—84-133552.

This volume contains a set of guidelines for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and

polychlorinated dibenzofurans (PCDFs), which should assist in the development of strategies for reducing the probabilities of accidents involving the environmental release of the above-mentioned substances, and the severity of their hazardous effects should such accidents occur. The report reviews strategies and actions concerned with replacing PCBs where used at present, developing contingency plans in the case of accidents, evaluating risks, rehabilitation after accidents and developing safe methods for decontamination, and disposal of contaminated wastes.

45678 **(PB—88-204219/XAB) Acid aerosols issue paper. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Feb 1988. 308p. (EPA—600/8-88/005A). NTIS, PC A14/MF A01.

This report evaluates scientific information on direct health effects associated with exposure to acid aerosols. The present report is not intended as a complete and detailed review of all literature pertaining to acid aerosols. Rather, an attempt has been made to focus on the evaluation of those studies providing key information on health effects and aerometrics. The report includes discussion of: the physical and chemical properties of acid aerosols; ambient monitoring techniques and ambient concentrations; the toxicology of acid aerosols in experimental animals, including a discussion of information on deposition and neutralization of acid aerosols; assessment of epidemiological studies of health effects of acid aerosols; assessment of controlled human-exposure studies evaluating the effects of acid aerosols; and a summarization of the above information with appropriate interpretations and conclusions. Lastly, important research needs are identified that are critical to be addressed in order to improve the data base for acid aerosols and associated health effects as a basis for decisions on whether to list acid aerosols as a criteria pollutant for development of criteria and national ambient air-quality standards.

45679 **(PB—88-204268/XAB) Advanced Utility Simulation Model: multi-period multi-state module design documentation (Version 1.0). Final report, October 1982-November 1984.** Edahl, R.; Tyle, N.; Talukdar, S.N.; Pachavis, N.L. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Electrical and Computer Engineering). Apr 1988. 29p. NTIS, PC A03/MF A01.

See also PB—88-204276.

This report is one of 11 in a series describing the initial development of the Advanced Utility Simulation Model (AUSM) by the Universities Research Group on Energy (URGE) and its continued development by the Science Applications International Corporation (SAIC) research team. The AUSM is one of four stationary-source emission and control cost-forecasting models developed by EPA for the National Acid Precipitation Assessment Program (NAPAP). The AUSM projects air pollution emissions (SO_2 and NOx), generating technology types and costs of operation, and combinations of fuels and emission-control technologies to simultaneously meet electric demand and emission constraints on a least-cost basis for each year through 2010. Thirteen electric-demand regions are simulated, and output is provided for each of the 48 states.

45680 **(PB—88-204565/XAB) Ambient NOx concentrations in the UK, 1976-84: a summary.** Williams, M.L.; Broughton, G.F.J.; Bower, J.S.; Drury, V.J.; Lilley, K. (Warren Spring Lab., Stevenage (UK)). 1987. 61p. (LR—632-(AP)M). NTIS, PC E06/MF E06.

This report summarizes NOx concentration data obtained at Warren Spring Laboratory (WSL) sites up to and including 1984. The statistics of NO and NO_2 concentrations are discussed, and an extreme value analysis of upper-percentile NO_2 concentrations is presented. The seasonal behavior, diurnal averages, and weekday/weekend differences of NO and NO_2 concentrations are discussed in terms of the more-important sources of NOx and the mechanisms for the production and loss of NO_2. An investigation of the NO_2/NOx relationship is presented.

45681 **(PB—88-205935/XAB) Engineering control of welding fumes. Research report.** Astleford, W. (Southwest Research Inst., Houston, TX (USA)). Sep 1974. 124p. (HHE—75-115). NTIS, PC A06/MF A01.

An experimental investigation was conducted to define satisfactory criteria for the control of welding and cutting fumes using local exhaust ventilation methods. Based on the tests with breathing level fume samples, shielded manual metal arc welding on carbon steel and stainless steel, and gas-shielded arc welding on carbon steel were judged to constitute the greatest potential health hazards. Analysis of breathing-zone fume samples indicated that the prevailing standard of capture velocity, i.e., 100 feet per minute, is extremely effective on controlling fume concentrations. Ventilation-system requirements were derived on the basis of a given set of ground rules which included environmental conditions and base materials. Recommendations are made for development of criteria for welding in confined spaces, welding with mixed facilities, and welding on paint-primed and zinc-coated base metals.

45682 **(PB—88-208723/XAB) Historic emissions of volatile organic compounds in the United States from 1900 to 1985. Final report, October 1986-March 1988.** Gschwandtner, G.; Wagner, J.K. (Pechan (E.H.) and Associates, Inc., Durham, NC (USA)). May 1988. 162p. NTIS, PC A08/MF A01.

This report gives an estimate of historic emissions of volatile organic compounds (VOCs) for each state (and the District of Columbia) of the contiguous U.S. Annual emissions were estimated on the national level from 1960 to 1985. For 1940, 1950, and every fifth year from 1960 to 1985, the national estimates of the U.S. EPA were used. For the other years, national emissions were estimated from national activity data and estimated emission factors for individual source categories. Major source categories include transportation, external combustion, industrial processes, solid-waste disposal, and miscellaneous others. State level emissions were estimated by applying allocation factors to the national emission estimates. The emissions from all source categories were aggregated to show the emission trend by state and Federal region and for the U.S. Seasonal emissions were estimated for each year. The uncertainty of the emission estimates was calculated based on the methodology developed previously by NAPAP. The data presented in Appendix B are available in Lotus 123 format on floppy disks.

45683 **(PB—88-210380/XAB) Estimating releases and waste-treatment efficiencies for the toxic chemical release inventory form. Final report.** Gerstle, R.; Perrin, D. (PEI Associates, Inc., Cincinnati, OH (USA)). Dec 1987. 206p. NTIS, PC A10/MF A01.

This document provides an overview of methods for estimating releases of chemicals into the environment for facilities subject to reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986. The methods include use of monitoring data, mass-balance calculations, emission factors, and engineering judgment. Applicability of the various methods for particular process operations and environmental media are discussed, as well as example release calculations for each method. The document also discusses various waste-treatment technologies and how to estimate treatment efficiency. The bibliography includes sources and availability of EPA air-emission-factor documents. Appendices include secondary waste-water treatment efficiencies for specific chemicals, fugitive emission factors for equipment leaks, storage-tank emission equations, and some chemical/physical property data for the Section 313 listed chemicals.

45684 **(PB—88-211685/XAB) Evaluating sources of indoor air pollution.** Tichenor, B.A.; Sparks, L.E.; White, J.B.; Jackson, M.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). May 1988. 17p. (EPA—600/D-88/086). NTIS, PC A03/MF A01.

This paper discusses a three-phase approach, employing environmental chambers, indoor air quality (IAQ) models, and test-house experiments, that is effective in linking sources of indoor pollutants to measured concentrations. Emission factors developed in test chambers can be used to evaluate full-scale indoor environments. A PC-based IAQ model has been developed that can accurately predict indoor concentrations of specific pollutants under controlled conditions in a test house. The model is also useful in examining the effect of pollutant sinks and variations in ventilation

parameters. Pollutants were examined from: (1) para-dichloro-benzene emissions from moth crystal cakes; and, (2) particulate emissions from unvented kerosene heaters. However, the approach has not been validated for other source types, including solvent based materials and aerosol products.

45685 **(PB—88-211701/XAB) Ambient air sampling with portable gas chromatographs.** Berkley, R.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring Systems Lab.). May 1988. 14p. (EPA—600/D-88/088). NTIS, PC A03/MF A01.

A Photovac 10S50 portable photoionization gas chromatograph mounted in a small automobile was used to sample air for organic vapors in Richmond and Hopewell, Virginia and in Staten Island, NY. A methylphenylsilicone column of 1.5-micrometer phase thickness was used with no backflush, and a 10 part per billion mixture of tetrachloroethylene in nitrogen was used as a field recalibration standard. Calibrant contamination of the unit was minimal, and background levels of compounds for which the unit was calibrated below 0.5 part per billion could be observed. These compounds were chlorobenzene, ethylbenzene, o-xylene, m-xylene, and bromobenzene. Large releases of benzene, toluene, and several compounds for which the unit had not been calibrated were observed.

45686 **(PB—88-211792/XAB) Ethylene oxide control technology development for hospital sterilizers. Final report for March 1986-September 1987.** Meiners, A.F. (Midwest Research Inst., Kansas City, MO (USA)). May 1988. 155p. (MRI—8691-L). NTIS, PC A08/MF A01.

The report discusses the development of ethylene oxide (EO) control technology for hospital sterilizers. Hospitals sterilize heat-sensitive items in gas sterilizers that use a mixture of EO (12 wt %) and a chlorofluorocarbon (CFC) (88 wt %). The active sterilizing agent is EO. The CFC is added as a flameproofing diluent. Two potential sterilizer emission-control systems were tested: catalytic oxidation and acid hydrolysis. In catalytic oxidation, relatively dilute mixtures of air and EO (12/88) are passed through a catalyst bed at 149-177 C. In acid hydrolysis, EO is hydrolyzed to ethylene glycol using H2SO4 (the CFC is unaffected). A full-scale system was tested under laboratory conditions, simulating a system that could be used for hospital sterilizers. The tests showed that the EO destruction efficiency was 99.9-99.999% of the EO reaching the device. However, 45-60% of the EO was absorbed by the ethylene glycol used in the closed-circuit liquid-ring vacuum pump. Each system has significant advantages and limitations.

45687 **(PB—88-211941/XAB) Revision of the industrial combustion emissions model to a base year of 1980. Final report, March-September 1985.** Hogan, T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). May 1988. 19p. NTIS, PC A03/MF A01.

This report describes the development of an updated 1980 base-year fuel consumption and air-pollution emissions estimates data base by state. These 1980 base-year data were incorporated into Industrial Combustion Emissions (ICE) model Versions 4.0, 5.0, and 6.0. The model is one of four stationary source emission and control cost forecasting models developed by EPA's Air and Energy Engineering Research Laboratory. It projects air pollution emissions (SO_2, sulfates, NOx, and particulate matter), costs, and fuel mix for industrial fossil-fuel-fired (natural gas, distillate and residual fuel oil, and coal) boilers by state and year (1980 baseline, 1985, 1990, 1995, 2000, 2010, 2020, and 2030). Model Version 6.0 is available for remote terminal access and operation at EPA's National Computer Center.

45688 **(PB—88-212287/XAB) Description of the Industrial Combustion Emissions Model (Version 6.0). Final report, December 1984-March 1986.** Hogan, T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). May 1988. 109p. (EPA—600/8-88/077). NTIS, PC A06/MF A01.

This report describes the model methodology, key assumptions, data sources, and user options for Version 6 of the Industrial Combustion Emissions (ICE) Model, one of a number of National Acid Precipitation Assessment Program emission forecasting models. Future ICE Model runs may include model modifications recommended by EPA. The ICE Model projects air-pollution emissions (sulfur dioxide, sulfates, and nitrogen oxides), costs, and fuel mix for industrial fossil-fuel-fired (natural gas, distillate and residual fuel oil, and coal) boilers by state and year (1985, 1990, 1995, 2000, 2010, 2020, and 2030).

45689 **(PB—88-213061/XAB) Effect of ventilation on emission rates of wood-finishing materials.** Tichenor, B.A.; Guo, Z. (Acurex Corp., Research Triangle Park, NC (USA)). May 1988. 14p. NTIS, PC A03/MF A01.

The paper gives results from EPA studies on the effect of ventilation (air changes per hour) and material loading on the emission rate for selected organics and total measured organics from three wood-finishing materials (stain, polyurethane, and wax). The data are analyzed to show the effect of ventilation on the emission characteristics of each material. The rate of emission of organic compounds from building materials varies according to type of material, material loading (area of material/volume of room), compound emitted, temperature, humidity, and ventilation rate. For some compounds and materials (e.g., formaldehyde from particle board), the relationship between emission rate and these variables is well established. For most materials and compounds, however, such relationships are unavailable. Research, using small test chambers, is being conducted by EPA to develop data on emission rates from a variety of building materials.

45690 **(PB—88-213236/XAB) Fourier-transform infrared spectrometry of ambient aerosols.** Pollard, M.; Jaklevic, J. (Lawrence Berkeley Lab., CA (USA). Engineering Div.). May 1988. 82p. NTIS, PC A05/MF A01.

Fourier-transform infrared (FTIR) spectrometry was evaluated as a method for determining the concentration of selected species present in ambient aerosols collected on Teflon filters. The filters are analyzed by transmission measurements after collection of the fine fraction (<2.5 micrometers diameter) of the ambient particles on 2 micrometers-pore-size Teflon filters. The spectra of the blank filters are subtracted from the spectra of the loaded filters and the area of the specific absorbance bands for ammonium, nitrate, and sulfate are measured and compared to calibration curves. The filter orientation must be maintained for all measured infrared spectra.

45691 **(PB—88-214697/XAB) Measurement of the chemical species that contribute to urban haze.** Stevens, R.K.; King, F.; Bell, J.; Highsmith, V.R.; Whitfield, J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). May 1988. 15p. (EPA—600/D-88/112). NTIS, PC A03/MF A01.

Measurements of the acidic (SO_2, HNO_3, and HNO_2) and basic (e.g., NH_3) gases that coexist with fine particles (<2.5 micrometers) are often used in models to determine the sources of species that contribute to the so-called urban haze. The measurement of these trace gaseous and particle contaminants by instrumental methods is often limited by instrumental sensitivity and by the interferences of other contaminates that coexist with the species of interest. An example of this problem is the measurement of NO_2 by chemiluminescence methods. This report describes a new denuder system and denuder coating arrangement that eliminates interferences between oxides of nitrogen species and improves the reliabilty and precision of measurements of HNO_2 and HNO_3. This paper also describes the physical properties and sampling characteristics of an annular denuder system tailored for visibility studies and presents results of measurements made to demonstrate precision and accuracy of data obtained with the annular denuder system.

45692 **(PB—88-214770/XAB) Bioindicators in air-pollution research: applications and constraints.** Tingey, D.T. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). May 1988. 14p. (EPA—600/D-88/116). NTIS, PC A03/MF A01.

See also PB—84-156280.

Physical and chemical measurements of air pollutants provide a precise measure of pollutant exposure frequently used to estimate probable biological impacts. Bioindicators may be classified as either accumulators of the pollutant or reactors to the pollutant.

The ultimate selection of a bioindicator depends on the pollutant and the ultimate use of the data. A bioindicator should: (1) provide a readily detectable response to the pollutant; (2) be easy and efficient to use; (3) be readily related to the response of interest; and (4) have a distinctive syndrome not readily confused with other causes. Bioindicators clearly have value in assessing environmental problems, but, at most, they are only indicators of a problem. Corrective or mitigative actions require additional data.

45693 **(PB—88-215215/XAB) Evaluation of emissions from selected uninventoried sources in the state of California. Final report, July 1986-April 1988.** Dickson, R.J.; Oliver, W.R.; Tate, S.R. (Radian Corp., Sacramento, CA (USA)). 29 Apr 1988. 149p. (DCN—88-264-003-05). NTIS, PC A07/MF A01.

The California Air Resources Board, maintains an extensive statewide emission inventory of criteria pollutants. This document ranks the emissions from 47 emission source categories that are not currently inventories. A primary objective of this study was to evaluate the significance of these uninventoried sources. A second objective was to develop methodologies for refining and spatially disaggregating emission estimates from the significant source categories. Source categories emitting volatile organic compounds were the primary focus of the study. Sources of ammonia (manure wastes) and particulate matter (wind-blown dust) were also considered. The project was conducted in two phases. In the first phase, preliminary emission calculations for the 47 source categories were prepared. The second phase of the project, focused on eight source categories selected from the ranking process. A detailed methodology for calculating statistical confidence intervals for the refined emission estimates was also developed and applied.

45694 **(PB—88-216791/XAB) Topical report on a field-monitoring study of homes with unvented gas space heaters. Volume 3. Methodology and results. Final report, January 1985-June 1987.** Koontz, M.D.; Nagda, N.L. (GEOMET Technologies, Inc., Germantown, MD (USA)). May 1988. 158p. (GEOMET-IE—1734). NTIS, PC A08/MF A01.

See also Volume 2, PB—88-101779.

During the period from January to March 1985, 157 residences in four Texas cities were monitored for pollutant concentrations and use of unvented gas space heaters (UVGSHs) and gas ranges. Average nitrogen dioxide (NO_2) and carbon monoxide (CO) concentrations and maximum/minimum indoor temperatures were monitored in all study homes. In selected homes, air infiltration rates and time-varying pollutant concentrations were measured. NO_2 concentrations in homes with UVGSHs as the primary source of heat averaged 250 parts per billion, and CO concentrations averaged 5.5 parts per million. The major predictor of NO_2 variations within and across homes was the difference between indoor and outdoor temperatures. Equations derived from multiple regression analysis and mass balance modeling were used to project the annual average NO_2 concentration in these homes. Actions such as substituting pilotless unvented gas appliances, adding wall and ceiling insulation, and reducing UVGSH emissions could be used to reduce NO_2 concentrations in such homes. Taking all three actions should result in substantially lowering the annual average NO_2 concentration.

45695 **(PB—88-216940/XAB) Photochemically reactive organic-compound emissions from consumer and commercial products. Final report.** Jones, A.; Rich, H.; Sewell, G.; Rogozen, M.; Katz, M. (Science Applications International Corp., McLean, VA (USA)). 26 Nov 1986. 184p. NTIS, PC A09/MF A01.

See also PB—85-204584.

This report estimates the emissions of volatile organic compounds (VOC) and photochemically reactive organic compounds (PROC) released from the use of consumer products in the States of California and New Jersey, and the New York metropolitan area. The report describes the data sources and methodologies used to estimate VOC and PROC emissions from consumer products, and presents emission estimates broken down by consumer-product subcategory and geographic region.

45696 **(UCRL—51444-87) Atmospheric and Geophysical Sciences Division: Program report, FY 1987.** (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013780/JAW.

In 1988 the Atmospheric and Geophysical Sciences Division began its 15th year as a division. As the Division has grown over the years, its modeling capabilities have expanded to include a broad range of time and space scales ranging from hours to years, and from kilometers to global, respectively. For this report, we have chosen to show a subset of results from several projects to illustrate the breadth, depth, and diversity of the modeling activities that are a major part of the Division's research, development, and application efforts. In addition, the recent reorganization of the Division, including the merger of another group with the Division, is described, and the budget, personnel, models, and publications are reviewed. 95 refs., 26 figs., 2 tabs.

45697 **(UCRL—97422) A parametric study of condensation growth and nucleation scavenging over large fires.** Edwards, L.L.; Penner, J.E. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 4p. (CONF-880871—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010710/JAW.

From 12. international conference on atmospheric aerosols and nucleation; Vienna, Austria (22 Aug 1988).

In this work we are concerned with nucleation scavenging of smoke particles over large fires, those of magnitudes associated with ignition due to nuclear blast. The amount of smoke injected into the atmospehre and the characterization of the smoke particle is uncertain. Some carbonaceous smoke particles act as efficient CCN although smoke from some kinds of petroleum fuels is not hygroscopic. The amount and nature of surface-active contaminants is unknown. To delineate the effects of the condensation and thermal accomodation coefficients, all processes of agglomeration, entrainment, and fallout are suppressed. Only early time nucleation and drop growth are considered in this study. 7 refs., 2 figs., 1 tab.

45698 **(UCRL—97811) The role of atmospheric chemistry in climate change.** Wuebbles, D.J.; Grant, K.E.; Connell, P.S.; Penner, J.E. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 15p. (CONF-880679—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012439/JAW.

From 81. annual meeting of Air Pollution Control Association; Dallas, TX, USA (1 Jun 1988).

Surface emissions and concentrations of globally important trace gases are increasing. Climate models indicate significant temperature increases could occur in the next century due to increasing CO_2 concentrations. However, the combined direct radiative effects from other trace gases could be as large as those estimated for CO_2. Many of these gases also have indirect effects on climate through their chemical interactions with other radiatively important atmospheric constituents. For example, within the troposphere, emissions of CH_4, CO, and NO/sub x/ may increase concentrations of hydroxyl (OH), which, while not radiatively important, has an important impact on tropospheric chemistry and on the concentrations of long-lived gases reaching the stratosphere. In the stratosphere, dissociation of CH_4, N_2O, and the CFCs can lead to changes in the ozone distribution. Oxidation of increasing CH_4 concentrations would increase stratospheric concentrations of radiatively important water vapor. Climate change can, on the other hand, alter tropospheric H_2O concentrations, further affecting chemistry impacts on climate. In this paper, we examine the importance of chemical processes and other interactions in determining climatic change and future policy options. 28 refs., 3 figs., 2 tabs.

45699 **Partial purification of gibberellin oxidases from spinach leaves.** Gilmour, S.J.; Bleecker, A.B.; Zeevaart, J.A.D. (Michigan State Univ., East Lansing (USA)). *Plant Physiology;* **85**: No. 1, 87-90(Sep 1987). Contract AC02-76ER01338.

Four enzyme activities catalyzing the following oxidative steps in the gibberellin (GA) biosynthetic pathway have been extracted from spinach (Spinacia oleracea L.) leaves after exposure to

8 long days: $GA_{12} \rightarrow GA_{53} \rightarrow GA_{44} \rightarrow GA_{19} \rightarrow GA_{20}$. Two of these, GA_{53} oxidase and GA^{19} oxidase, were separable from the other two, GA_{44} oxidase and GA_{12} 13-hydroxylase, by anion exchange high performance liquid chromatography (HPLC). Apparent molecular weights of the four enzymes as determined by gel filtration HLPL are: GA_{12} 13-hydroxylase, 28,400; GA_{53} oxidase, 42,500; GA_{44} oxidase, 38,100; GA_{19} oxidase, 39,500. GA_{44} oxidase was purified approximately 100-fold in 0.3% yield by a combination of ammonium sulfate fractionation, anion exchange HPLC, phenyl-Sepharose chromatography and gel filtration HLPC.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 44626, 45070, 45464, 45485, 45486, 45845, 45846, 46158

45700 **Aerodynamic size associations of natural radioactivity with ambient aerosols.** Bondietti, E.A.; Papastefanou, C.; Rangarajan, C. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 377-399 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

The aerodynamic size distributions of Pb-214, Pb-212, Pb-210, Be-7, P-32, S-35 (as SO/sub 4//sup 2-/), and stable SO/sub 4//sup 2-/ were measured using cascade impactors. The activity distribution of Pb-212 and Pb-214 was largely associated with aerosols smaller than 0.52 μm. Based on 46 measurements, the activity median aerodynamic diameter of Pb-212 averaged 0.13 μm (σ/sub g/ = 2.97), while Pb-214 averaged 0.16 μm (σ/sub g/ = 2.86). The larger median size of Pb-214 was attributed to α-recoil depletion of smaller aerosols following decay of aerosol-associated Po-218. Subsequent Pb-214 condensation on all aerosols effectively enriches larger aerosols. Pb-212 does not undergo this recoil-driven redistribution. Low-pressure impactor measurements indicated that the mass median aerodynamic diameter of SO/sub 4//sup 2-/ was about three times larger than the activity median diameter of Pb-212, reflecting differences in atmospheric residence times as well as the differences in surface area (Pb-212) and volume (SO/sub 4//sup 2-/) distributions of the atmospheric aerosol. Cosmogenic radionuclides, especially Be-7, were associated with smaller aerosols than SO/sub 4//sup 2-/ regardless of season, while Pb-210 distributions in summer measurements were similar to sulfate but smaller in winter measurements. Even considering recoil following Po-214 α-decay, the average Pb-210-labeled aerosol grows by about a factor of two during its atmospheric lifetime. The presence of 5 to 10% of the Be-7 on aerosols greater than 1 μm was indicative of post-condensation growth, probably either in the upper atmosphere or after mixing into the boundary layer.

45701 **Measurements of radon concentrations in residential buildings in the Eastern United States.** George, A.C.; Hinchliffe, L.E. (Environmental Measurements Lab., U.S. Dept. of Energy, New York, NY (US)). pp 42-62 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

As part of a program to develop and test radon survey techniques, passive activated carbon samplers were used to measure radon concentrations in 380 buildings in six states in the eastern United States. Measurements were made in the basement and living areas of each residential building, and in some work locations of several plant buildings during summer and winter. The activated carbon samplers performed well in these tests, and the logistics via U.S. mail were satisfactory. The lowest concentrations of radon were found in: Long Island, NY, Luzerne County, PA, and South Carolina. The remainder of the test areas showed a substantial number of buildings to have radon levels above the Environmental Protection Agency's and the National Council on Radiation Protection and Measurement's guideline action levels. The arithmetic mean concentrations of radon in the living areas in the different regions ranged from 1.1 rhoCi/1 to 9.3 rhoCi/1 (0.0055 to 0.0465 WL) during the winter months. The dose equivalent rate to the bronchial epithelial cells of the occupants of these buildings ranged from 1.4 to 10.7 rem/yr. Although only one area lies on the Reading Prong, which extends through New Jersey, several of the regions can be considered hot area or anomalous regions with similar problems as the Prong. The estimated risk from the observed radon distributions is such that a substantial fraction of the northeastern United States population is exposed to levels high enough to warrant immediate attention.

45702 **Investigations of soil as a source of indoor radon.** Sextro, R.G.; Moed, B.A.; Nazaroff, W.W.; Revzan, K.L.; Nero, A.V. (Indoor Environment Program, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp 10-29 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

The predominant source of indoor radon in most single-family housing in the U.S. is the soil adjacent to the house substructure. The authors examined factors influencing the production and transport of radon in soil and into buildings. A number of important parameters have been identified and their effect on radon production and migration assessed, including radium concentration, moisture content, air permeability, and grain size distribution of soils. The potential regional variations in parameters affecting radon have been evaluated by examining geographic data, including surface radium concentrations and general soil data. We have also investigated factors influencing radon migration into individual dwellings. Coupling between the building shell and the surrounding soil has been demonstrated experimentally, and pressure-field mapping and soil permeability measurements have been carried out.

5006 Regulations

REFER ALSO TO CITATION(S) 45263, 45663, 45678

45703 **(PB—88-204243/XAB) Development of proposed standard test method for spray-painting transfer efficiency. Volume 1. Laboratory development. Final report, January 1982-January 1987.** Kennedy, K.C. (Centec Corp., Reston, VA (USA)). Apr 1988. 152p. NTIS, PC A08/MF A01.

See also PB—86-174059, and Volume 2, PB—88-204250.

This two-volume report gives results of a program to develop and verify a standardized spray-painting transfer-efficiency test method. Both review of the literature and laboratory research were conducted. Transfer-efficiency measurement methods presently used by industry were evaluated and compared. The best characteristics of these methods were incorporated into the final proposed standard method. The resulting method was determined to be viable for laboratory evaluations. It still awaits adaptation and verification for production-line applications.

45704 **(PB—88-204250/XAB) Development of proposed standard test method for spray-painting transfer efficiency. Volume 2. Verification program. Final report, January 1982-January 1987.** Kennedy, K.C. (Centec Corp., Reston, VA (USA)). Apr 1988. 187p. NTIS, PC A09/MF A01.

See also Volume 1, PB—88-204243.

This two-volume report gives results of a program to develop and verify a standardized spray-painting transfer-efficiency test method. Both review of the literature and laboratory research were conducted. Transfer-efficiency measurement methods presently used by industry were evaluated and compared. The best characteristics of these methods were incorporated into the final proposed standard method. The resulting method was determined to be viable for laboratory evaluations. It still awaits adaptation and verification for production-line applications.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 45877

45705 (DOE/ER/13830—1) Studies on the control of plant cell enlargement by cellular parameters: Progress report, July 1, 1987-June 30, 1988. Cleland, R.E. (Washington Univ., Seattle (USA). Dept. of Botany). 20 Jun 1988. Contract FG06-88ER13830. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012990/JAW.

The overall goal of this research is to determine the mechanisms by which the hormone auxin regulates plant cell enlargement. A general picture of one mechanism, the acid-growth mechanism, has emerged, largely from studies in this laboratory on Avena coleoptiles. It states that in auxin-responsive stem and coleoptile cells, auxin enhances the rate of excretion of protons from the cells. The resulting lowered pH in the apoplastic solution activates enzymes in the wall which cleave load-bearing bonds. The resulting wall loosening permits the cell to take up water, enlarge and extend the wall. Auxin plays additional roles in cell enlargement through effects on wall synthesis and protein synthesis; however, these effects result in the maintenance of the acid-induced wall loosening process but do not initiate wall loosening. 8 refs., 7 figs., 2 tabs.

45706 (INIS-mf—11265) 7. national seminar Nuclear methods in mining, geology, geophysics and geochemistry. Collection of abstracts. Simon, L. (ed.). (Ceskoslovenska Vedeckotechnicka Spolecnost, Prague. Ceskoslovensky Vybor pro Energetiku a Jadernou Techniku). 1987. 36p. (In Czech, and Slovak). (CONF-8709314—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703271/JAW.

From Nuclear methods in mining, geology, geophysics and geochemistry; Marianska, Czechoslovakia (21 Sep 1987).

The proceedings contain 28 abstracts of papers presented at the seminar. They mainly deal with the use of synchrotron radiation, logging methods, Moessbauer spectroscopy, tracer techniques, radiometric analysis, X-ray fluorescence analysis, neutron activation analysis and other nuclear methods in mining, geology, geophysics and geochemistry. (J.B.).

45707 (PNL-SA—14779) The development of water stress in Bromus tectorum and Poa secunda in the field. Link, S.O.; Downs, J.L.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013117/JAW.

Field observations of the phenological development, root and shoot characteristics, and water relations with increasing water stress of Bromus tectorum and Poa secunda were compared. The phenological development of B. tectorum was 3 to 4 weeks behind that of P. secunda. The root/shoot ratio of B. tectorum was 4 to 5 times less than that of P secunda. The greatest rooting depth was 45 cm for B. tectorum and 35 cm for P. secunda. Most of the root mass was found in the top 10 cm of soil for both species. Water stress developed sooner and to a greater degree in P. secunda than in B. tectorum. Xylem water potential was lower in P. secunda than in B. tectorum and the difference increased through the season. Pre-dawn xylem water potential was highly correlated with maximal stomatal conductance in P. secunda. Hydraulic conductance was greater in B. tectorum than in P. secunda, and decreased as water stress increased through the season. Stomatal conductance and transpiration were greater for B. tectorum than for P. secunda. Midday stomatal closure occurred later in the season and to a lesser degree for B. tectorum than for P. secunda. 31 refs., 7 figs., 1 tab.

45708 Previous sludge addition effects on nitrogen mineralization in freshly amended soil. Lindeman, W.C.; Connell, G.; Urquhart, N.S. (New Mexico State Univ., Las Cruces (USA)). *Soil Science Society of America Journal;* **52**: No. 1, 109-112(Jan-Feb 1988). Contract AS04-76ET33626;AC04-83AL21776.

An experiment was conducted to determine the effects of previous sludge additions on N mineralization in a freshly amended soil. A secondary objective was to further delineate statistical models of N mineralization potential (N_0) and the mineralization rate constants k and h. The Glendale clay soil (fine-silty, mixed thermic, Typic Torrifluvents), with either no previous sludge amendment or sludge applied at the rate of 67.3 Mg ha^{-1} in 1982 or 1983 in the field, was freshly amended with 30 g kg^{-1} of gamma irradiated, dried, anaerobically digested sewage sludge in 1985. Triplicate samples of each soil (unamended, amended in 1982, and amended in 1983) and each sludge treatment (no amendment and freshly amended) were incubated aerobically for 16 wk at 0.01-MPa moisture potential and 35°C. Periodically the soils were leached with 0.01 M $CaCl_2$, and the leachate was analyzed for inorganic and organic N. Previous sludge amendment had no effect on the mineralization of fresh sludge. Soils previously amended in 1982 and 1983 leached 56 to 60 mg kg^{-1} more $NO_3^- + NO_2^-$ than unamended or freshly amended soils never amended with sludge. Total organic N mineralization averaged 65.4% and was independent of soil amendment history or fresh sludge amendment. Values of N_0, k, and h were estimated by nonlinear least squares for several nonlinear models. The best fit of the data resulted from modeling N mineralization as the sum of an exponential equation (of the rapidly decaying organic N fraction) and a constant (of the slowly decaying organic N fraction).

45709 Reevaluation of the -3/2 power rule of plant self-thinning. Weller, D.E. (Oak Ridge National Lab., TN (USA)). *Ecological Monographs;* **57**: No. 1, 23-43(Mar 1987). Contract AC05-84OR21400.

The self-thinning rule predicts that for a crowded even-aged plant population a log-log plot of average plant mass vs. plant density will reveal a straight self-thinning line of slope -3/2. The rule is supported by examples from many individual populations, and by the existence of an interspecific relationship that yields a line of slope -3/2 in a log-log plot displaying average mass and density data from many populations of different species. The author examined and reanalyzed the evidence to evaluate the strength of support for this widely accepted rule. Some problems in fitting thinning lines and testing agreement with the rule have no truly satisfactory solution, but three improvements on commonly used methods were made: the analysis related stand biomass density to plant density because the alternative of relating average plant mass to plant density is statistically invalid; principal components analysis was used rather than regression, because regression relies on unrealistic assumptions about errors in the data; and statistical tests of hypotheses were used to interpret the results. Despite the failure of the thinning rule for individual populations, the combined data for all populations are still consistent with an interspecific relationship of slope -3/2; therefore, the existence of the interspecific relationship does not necessarily support the within-population thinning rule. The within-population and interspecific relationships are apparently different phenomena that may arise from different constraints, so the two relationships should be tested and explained separately.

45710 Equilibrium and nonequilibrium concepts in ecological models. DeAngelis, D.L.; Waterhouse, J.C. (Oak Ridge National Lab., TN (USA)). *Ecological Monographs;* **57**: No. 1, 1-21(Mar 1987). Contract AC05-84OR21400.

Mathematical models and empirical studies have revealed two potentially disruptive influences on ecosystems; (1) instabilities caused by nonlinear feedbacks and time-lags in the interactions of biological species, and (2) stochastic forcings by a fluctuating environment. Because both of these phenomena can severely affect system survival, ecologists are confronted with the question of why complex ecosystems do, in fact, exist. The authors study analyzes the basic theme of this research and identifies five general hypotheses that, in recent years, theoretical ecologists have built into models to increase their stability against disruptive feedback and stochasticity. To counter feedback instabilities, theoreticians have considered (1) functional interactions between species that act as stabilizers, (2) disturbance patterns that interrupt adverse feedback effects, and (3) the stabilizing effect of integrating small-spatial-scale systems into large landscapes. To decrease the influence of stochasticity, modelers have hypothesized (4) compensatory mechanisms

operating at low population densities, and (5) the moderating effect of spatial extent and heterogeneity. They show that modeling based on these ideas can be organized in a systematic way. They also show that the stable equilibrium state should not be viewed as a fundamental property of ecological systems, but as a property that can emerge asymptotically from extrapolation to sufficiently large spatial scales.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 45431, 45748, 45853, 45854, 45856

45711 (CIEMAT—607) Summary of the species of Spanish vegetation sensitive to different pollutants. Varela Gonzales, J.; Sanchez Cabrero, B.; Sanchez Gimeno, B. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 153p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88702840/JAW.

A detail literature review of the sensitivity of the species of Spanish vegetation to various pollutants was made. An impact scale was created to describe the qualitative degree of sensitivity to which each specie is affected by major atmospheric pollutants: very sensitive, sensitive, intermediate sensitive and resistent. This type of study, combined with studies of emission, concentration and dispersion of air pollution, is of great interest to evaluate the environmental impact to the vegetation community. (author) 45 refs.

45712 (EPRI/EA/EL—5612, pp 3.1-3.4) Fate of PCBs in soil and water. Brown, J.F. Jr.; Wagner, R.E.; Beard, D.L.; Carnahan, J.C.; Unterman, R. (General Electric Research and Development Center, Schenectady, NY (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Until recently, there existed two contradictory perceptions regarding the behavior of PCBs in the general environment. One was that the commercial PCBs (Aroclors) were essentially indestructible, and would persist indefinitely at spill sites unless removed by some form of remedial action. The other was that the analytical gas chromatograms of PCBs recovered from environmental samples rarely matched those of either individual or mixed Aroclors, so that various arbitrary conventions were needed in order to report environment PCB analyses in terms of Aroclor compositions. The chromatographic mismatch was attributed to weathering of the PCBs. During the past four years, the authors have been studying the composition of environmental PCBs with high-resolution capillary gas chromatography and mass spectrometry in order to better characterize the PCB weathering phenomenon and identify its origins. It is now apparent that it includes at least four different types of PCB alteration processes: partitioning into a mobile phase, oxidative biodegradation, reductive biodegradation (dechlorination), and photolysis by sunlight (1-6). These four processes, their environmental requirements, their recognition features, and their influence on PCB fate are described in turn. 6 references.

45713 (EPRI/EA/EL—5612, pp 6.6-6.10) Attenuation of polychlorinated biphenyls in soils. Girvin, D.C.; Sklarew, D.S.; Scott, A.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Ability to predict the long-term mobility of PCBs in the soil-water environment is of particular interest to the electric-utility industry and regulatory agencies because of the history of use of PCBs as a coolant-insulation fluid and their resistance to degradation. This paper describes the influence that adsorption/desorption has upon PCB mobility in soils and current experimental work to (1) establish correlative relationships that can be used to estimate equilibrium sorption parameters from easily measured soil characteristics and well-established physical properties of PCBs; and (2) measure the release rates under non-equilibrium conditions of PCB congeners from utility soils containing Aroclor mixtures. The approach being used in this program to describe the role of sorption/desorption on PCB mobility in soils is also applicable to other hydrophobic organic compounds, such as the polynuclear aromatic hydrocarbons (PAHs), which are present in the soils at Town Gas sites. 11 references.

45714 (IVA—310, pp 17-25) Inventory of forest damage in Sweden. Bengtsson, G. (Swedish Univ. of Agricultural Sciences, Umeaa (Sweden). Dept. of Forest Survey). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

This paper gives a short review of inventory and monitoring activities concerning the vitality of forests in Sweden, started or performed during 1984, and presents some inventory results from 1984.

45715 (IVA—310, pp 31-44) Soil acidification and metal solubility in forests of south Sweden. Tyler, G. (Univ. of Lund, Lund (Sweden). Metal Ecology Group). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

Far-reaching acidification of forest soils has occurred in south Sweden during the last decades. The decreasing pH has, directly or indirectly, increased the solubility of several elements in the soil, including magnesium, aluminium, cadmium and zinc. This has resulted in high concentrations of these elements in the soil-water and a considerably greater output than input from the forest ecosystems. Both deciduous and coniferous forest soils have become acidified but the solubilization and flow of metals is greater in spruce stands than in beech and birch stands on originally similar soil.

45716 (NILU-OR—6/87) Reduced corrosion damage from reduced SO-2 emission. Step II. Testing of methods. Report year 1986. Henriksen, J.F. (Norsk Inst. for Luftforskning, Lillestroem). Feb 1987. 16p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753708/JAW.

The report discusses statistical data to be used for the sensitivity analysis on corrosion risks for building materials in relation to the various SO-2 pollution levels in densely built-up areas in Norway. The corrosion risks for the transmission poles are briefly discussed. 2 drawings, 3 tables.

45717 (NP—8770237) Lead and cadmium pollution load of selected rooms in houses at Oker/Harlingerode (1983/1984). Seifert, B.; Drews, M. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Feb 1985. 72p. (In German). NTIS (US Sales Only), PC A04. Order Number DE88770237/JAW.

From February 1983 to July 1984, the homes of 24 families living at varying distances from a lead works were examined for levels of pollution in the different rooms. The method by which dust was collected in the people's homes for the analysis of the two elements was simplified as compared to former practice in that the collecting vessels were no longer filled with water. In houses remote from the works, lead and cadmium concentrations were mostly found to be below 10 microgrammes per square metre and day and below 0.3 microgrammes/square metre/day, respectively. By contrast, the average values for residential rooms in the vicinity of the works were in general below 50, respectively 0.5, microgrammes per square metre and day. In rooms less efficiently sealed against the outside air, like lofts and cellars, the values found were considerably higher in part. There was not in every instance a parallel development of values for the rooms of houses to the results of investigations of outside air in the immediate vicinity of the house, suggesting that individual aeration behaviour plays an important part. It is therefore not possible to derive from outside-air investiga-

tions more than a rough orientation as to the heavy-metal pollution load in rooms. (orig./MG) With 29 figs., 20 tabs.

45718 **(PB—88-201181/XAB) Clay-liner construction and quality control.** Peirce, J.J.; Sallfors, G.; Peterson, E. (Duke Univ., Durham, NC (USA). Dept. of Civil and Environmental Engineering). 1986. 14p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Environmental Engineering, Vol. 112, No. 1, 13-24(Feb 1986).

Soil handling and liner-construction practices at hazardous-waste-management facilities are documented. Soil characterizations, processing techniques, construction methods, and quality control of constructed liners are reviewed and compared. Results indicate widely different testing and construction methods at 23 facilities nationwide. Laboratory research indicates that selected clay soils exhibit low hydraulic conductivity to water and certain non-water liquid wastes. This characteristic makes clay soils potentially useful as liner materials at hazardous-waste-management facilities. Such facilities have been constructed and, although the intended barrier function of the liners is always the same, testing and construction techniques are seen to vary from site to site. The need for parallel laboratory hydraulic conductivity testing and practices in field preparation of clay soils is noted.

45719 **(PB—88-208434/XAB) Pilot-scale evaluation of sludge landfilling: four years of operation. Final report, July 1982-June 1986.** Stamm, J.W.; Walsh, J.J. (SCS Engineers, Inc., Covington, KY (USA)). May 1988. 256p. NTIS, PC A12/MF A01.

A sludge landfill-simulator program consisting of 28 lysimeters was used to evaluate sludge landfilling as a disposal option by assessing the environmental impacts on leachate composition and gas production. The disposal scenarios investigated were codisposal, refuse-only, and sludge-only. Lysimeters were housed at U.S. EPA's Test and Evaluation Facility in Cincinnati, Ohio. Thirty-four parameters were measured to document leachate and gas quality and quantity. In addition, certain lysimeters were spiked with a priority pollutant solution to investigate the generation of potentially hazardous leachate. The study presents the results of four years of research, from July 1982 to June 1986. A review of leachate and gas-quality data suggests that the codisposal of sludge and refuse is a superior means of disposal.

45720 **Anaerobic microbial dissolution of transition and heavy metal oxides.** Francis, A.J.; Dodge, C.J. (Brookhaven National Lab., Upton, NY (USA)). *Applied and Environmental Microbiology;* 54: No. 4, 1009-1014(Apr 1988). Contract AC02-76CH00016.

An anaerobic N-fixing Clostridium sp. with an acetic, butyric, and lactic acid fermentation pattern, isolated from coal-cleaning waste, solubilized Fe_2O_3 and MnO_2 by direct enzymatic reduction; CdO, CuO, PbO, and ZnO were solubilized by indirect action due to the production of metabolites and the lowering of the pH of the growth medium. Extracellular heat-labile components of the cell-free spent medium obtained from cultures without oxide solubilized a significant amount of Fe_2O_3; however, direct contact with the bacterial cells resulted in the complete dissolution of the oxide. Under identical conditions, the cell-free spent medium solubilized only a small amount of MnO_2, whereas 2.3 μmol of the oxide was solubilized by direct bacterial contact. Reduction of Fe_2O_3 and MnO_2 by Clostridium sp. proceeds at different rates and, possibly, by different enzymatic systems. Fe(III) and Mn(IV) oxides appear to be used as sinks for excess electrons generated from glucose fermentation. Dialysis bag experiments with Co_2O_3 indicate that there is a slight dissolution of Co followed by precipitation or biosorption. Although Mn_2O_3, Ni_2O_3, and PbO_2 may undergo reductive dissolution from a higher to a lower oxidation state, dissolution by direct or indirect action was not observed. Also, Cr_2O_3 and NiO were not solubilized by direct or indirect action. Significant amounts of solubilized Cd, Cu, and Pb were immobilized by the bacterial biomass, and the addition of Cu^{2+} inhibited the growth of the bacterium.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 44698, 44708, 44744, 44771, 44777, 44811, 44825, 45070, 45427, 45702, 45773, 45845

45721 (CONF-871075—Vol.1-Pt.3, pp 333-350) **Allowable residual contamination levels of radionuclides in soil from pathway analysis.** Nyquist, J.E.; Baes, C.F. III. (Oak Ridge National Lab., TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The Remedial Action Program (RAP) at Oak Ridge National Laboratory will include well drilling, facility upgrades, and other waste management operations likely to involve soils contaminated with radionuclides. A preliminary protocol and generalized criteria for handling contaminated soils is needed to coordinate and plan RAP activities, but there exists only limited information on contaminate nature and distribution at ORNL RAP sites. Furthermore, projections of long-term decommissioning and closure options for these sites are preliminary. They have adapted a pathway analysis model, DECOM, to quantify risks to human health from radionuclides in soil and used it to outline preliminary criteria for determining the fate of contaminated soil produced during RAP activities. They assumed that the site could be available for unrestricted use immediately upon decontamination. The pathways considered are consumption of food grown on the contaminated soil, including direct ingestion of soil from poorly washed vegetables, direct radiation from the ground surface, inhalation of resuspended radioactive soil, and drinking water from a well drilled through or near the contaminated soil. We will discuss the assumptions and simplifications implicit in DECOM, the site-specific data required, and the results of initial calculations for the Oak Ridge Reservation.

45722 **(DOE/ID/12584—23) Detecting buried radium contamination using soil-gas and surface-flux radon measurements.** Karp, K.E. (UNC Geotech, Grand Junction, CO (USA)). Jun 1988. Contract AC07-86ID12584. 63p. (UNC/GJ—41(TMC)). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012796/JAW.

The Technical Measurements Center (TMC) has investigated the effectiveness of using radon soil-gas under surface-flux measurments to locate radium contamination that is buried sufficiently deep to be undetectable by surface gamma methods. At the first test site studied, an indication of a buried source was revealed by mapping anomalous surface-flux and soil-gas concentrations in the near surface overburden. The mapped radon anomalies were found to correspond in rough outline to the shape of the areal extent of the deposit as determined by borehole gamma-ray logs. The 5.9pCi/g radium deposit, buried 2 feet below the surface, went undetected by conventional surface gamma measurements. Similar results were obtained at the second test site where radon and conventional surface gamma measurements were taken in an area having radium concentrations ranging from 13.3 to 341.0 pCi/g at a depth of 4 feet below the surface. The radon methods were found to have a detection limit for buried radium lower than that of the surface gamma methods, as evidenced by the discovery of the 13.3 pCi/g deposit which went undetected by the surface gamma methods. 15 refs., 33 figs., 8 tabs.

45723 **(ENEA-RT-DISP—87-6) Radiological survey of Abruzzo and Molise Regions in Italy (15-23 July 1986).** Belli, M.; Feroce, C.; Poggi, M.; Sansone, U. (ENEA, Rome (Italy)). Dec 1987. 51 p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754250/JAW.

The results of a radiological survey, two months after the Chernobyl accident, are reported. The study was oriented by the peculiar, orographic characteristics of the two regions. On the basis of the collected data and radiometric results, the radiological pattern of the two regions was defined.

45724 (IAEA-TECDOC—440, pp 337-345) **Dynamic model of the transfer of tritium through foodchains: Sensitivity of dose predictions to variations in key parameters.** Brearley, I. (UKAEA Safety and Reliability Directorate, Culcheth). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Recently, we have developed a dynamic foodchain model for elemental tritium and tritiated water vapour. The dynamic nature of the model, called TRIDOS, enables both seasonal effects and short duration discharges to be studied. Reasonable agreement has been obtained between model predictions and experiment. In application of models of this type there is clearly some uncertainty, since, for example, some of the key variables are subject to stochastic variability or are not well known. There is considerable interest in the impact of these uncertainties upon dose estimations. In this paper, following a brief description of the TRIDOS model, some of the key parameters are identified and their possible ranges of values discussed. Then, the impact of varying these parameters within the ranges, on calculated foodchain doses is estimated. (author). 10 refs, 7 figs.

45725 (INIS-mf—11218) **Report on the levels of radiocaesium activity in mountain sheep October-December 1987.** Colgan, P.A. (Nuclear Energy Board, Dublin (Ireland)). Feb 1988. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88702873/JAW.

This report details the in vivo monitoring of mountain sheep undertaken by the Nuclear Energy Board during the period 5th October to 18th December 1987. A total of 636 farms in upland areas in eight counties were visited and 7,429 sheep were monitored. In addition, monitoring of sheep for the home and export market was undertaken at five slaughterhouses where a further 779 animals were examined. The farm monitoring identified 989 sheep with radiocaesium activities above 600 Bq/kg, of which 162 were above 1000 Bq/kg. Statistical testing was used to identify areas deemed to be 'reserved' and 'cleared' in each of the counties visited. It is concluded that the imposition of restrictions on the movement and slaughter of sheep may not be the most effective means of preventing animals with unacceptably high radiocaesium concentrations reaching the market. A programme of farmer education in stock management, allied to in vivo monitoring at slaughterhouses serving both the domestic and export markets, is put forward as the most effective method of ensuring the protection of the public.

45726 (ORNL/TM—10053) **Results of the radiological survey at the Ventron Site, Beverly, Massachusetts.** Cottrell, W.D.; Carrier, R.F. (Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88013351/JAW.

The results of a radiological survey of the Ventron site in Beverly, Massachusetts, are presented in this report. From 1942 through 1948, the site was used for various projects involving the production of uranium metal powder from uranium oxide and the recovery of uranium from scrap metal. In 1980 and 1982, a comprehensive radiological survey of the site was conducted by the Oak Ridge National Laboratory. Included were measurements of the following: residual alpha- and beta-gamma contamination levels inside the buildings; external gamma radiation levels at 1 m above the surface and at the surface in the buildings and outdoors; and uranium, radium, and thorium concentrations in surface soil outdoors and beneath the buildings. The results show the presence of residual radioactive contamination, largely uranium with lesser amounts of thorium and radium, in outdoor soil and in fill material beneath Buildings B-1, B-2, and C-1. In summary, concentrations of residual radioactive material found in buildings and soils at the site are in excess of concentration guidelines established by the Department of Energy to determine if a site needs to be considered for remedial action. These guidelines are typically derived to ensure that unrestricted use of the facility (including residential use) will not result in above-guideline doses to the general public. An examination of work/occupancy scenarios for this site suggests that the annual radiation exposures to personnel from any credible current use scenario would be well below dose limits which would be applied to protect members of the general public from exposure to radiation. 3 refs., 35 figs., 15 tabs.

45727 (SKB-TR—87-18) **Calculation of gas migration in fractured rock.** Thunvik, R.; Braester, C. (Royal Inst. of Tech., Stockholm (Sweden); Technion-Israel Inst. of Tech., Haifa). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Royal Inst. of Tech., Stockholm (Sweden); Technion-Israel Inst. of Tech., Haifa). Sep 1987. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754368/JAW.

Calculations are presented for rock properties characteristic to the Forsmark area. The rock permeability was determined by flow tests in vertical boreholes. It is assumed that the permeability distribution obtained from these boreholes is representative also for the permeability distribution along the repository cavern. Calculations were worked out for two different types of boundary conditions, one in which a constant gas flow rate equivalent to a gas production of 33000 kg/year was assumed and the other in which a constant gas cushion of 0.5 metres was assumed. For the permeability distribution considered, the breakthrough at the sea bottom occurred within one hour. The gaswater displacement took place mainly through the fractures of high permeability and practically no flow took place in the fractures of low permeability.

45728 (SKB-TR—87-19) **Calcualation of gas migration in fractured rock - a continuum approach.** Braester, C.; Thunvik, R. (Technion-Israel Inst. of Tech., Haifa; Royal Inst. of Tech., Stockholm (Sweden)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Technion-Israel Inst. of Tech., Haifa; Royal Inst. of Tech., Stockholm (Sweden)). Sep 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754369/JAW.

A study of gas migration from low level radioactive repositories in which the fractured rock mass was conceptualized as a continuum, was carried out by the aid of a computer program based on a finite difference numerical method of solution to the equations of flow. The calculations are intended to correspond to the prevailing in the Forsmark low level repository area where radioactive waste repository caverns are planned to be located at a depth of about 50 metres below the sea level. Calculations were worked out for a constant gas flow rate equivalent to a gas production of 20 000 normal cubic metres per year. The investigated flow domain was a vertical cross-section passing through the repository. The results show that in the empty cavern the gas formed in the cavern moves almost instantaneously upward amd accumulates below the roof of the cavern.

45729 (SRD-R—442) **Dry deposition to vegetated surfaces: parametric dependencies.** Underwood, B.Y. (UKAEA Safety and Reliability Directorate, Culcheth). Dec 1987. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754294/JAW.

The dry deposition velocity of airborne pollutants to vegetated surfaces depends on the physico-chemical form of the pollutant, on meteorological conditions (windspeed, atmospheric stability) and on characteristics of the surface cover. This report examines these dependencies, drawing on experimental data and on information from theoretical analyses. A canopy model is outlined which uses first-order closure of the equations for turbulent transport of momentum (or matter), with losses of momentum (or matter) to individual canopy elements parameterised in terms of the mean windspeed: the model has previously been tested against experimental data on an artificial 'grass' canopy. The model is used to elucidate the features of the dependence of deposition velocity on windspeed and on whether the pollutant is in gaseous or particulate form: in the former case, the dependence on the molecular diffusivity of the gas is shown; in the latter case, dependencies on particle diameter and density are deduced. The predictions are related to available measurements. Additional hypotheses are introduced to treat the influence of atmospheric stability on deposition, and the analysis is used to shed light on the somewhat confusing picture that has emerged from past experimental studies. In considering the dependence of deposition velocity on the structural properties of the vegetation, it is established that more parameters than the single one

conventionally used -aerodynamic roughness length - are needed to characterise the surface cover. Some indications of the extent of variation in deposition velocity from one type of vegetation to another are elicited from the model.

5104 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 44989

5105 Site Resource And Use Studies

45730 (DOE/EV/00703—T1-Vol.1, pp 1-16) **Research at Enewetak Atoll: a historical perspective.** Helfrich, P.; Ray, R. (Univ. of Hawaii, Kaneoke (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

Between 1946 and 1958, 43 nuclear devices were tested at Eniwetok. This testing program provided an opportunity for research which eventually led to the establishment of the Eniwetok Marine Biological Laboratory in 1954. From 1954 to 1974 research was broadly aimed at increasing their knowledge of this diverse coral atoll ecosystem. The second period of research began with the reorganization of the laboratory in 1974. The major projects of the 1975-1980 period were (1) a study of the circulation of the Eniwetok Lagoon, (2) research on the dynamics of ground water resources of Eniwetok Atoll, and (3) studies of diguatera fish poisoning at Eniwetok.

45731 (DOE/EV/00703—T1-Vol.1, pp 17-25) **History of the people of Enewetak Atoll.** Kiste, R.C. (Univ. of Hawaii, Honolulu (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

This chapter focuses upon the people of Enewetak. It examines their history, the structure of their culture and society, the ways they have coped with the colonial powers that governed the islands, and their response to their resettlement on Ujilang Atoll. Some mention is necessarily made of the Bikini community because the histories of the two peoples are intertwined.

45732 (DOE/EV/00703—T1-Vol.1, pp 27-35) **Physiography of Enewetak Atoll.** Colin, P.L. (Univ. of Papua New Guinea, Port Moresby (Indonesia)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

The author discusses the location, size, weather and climate of Eniwetok. The environment is also described, focusing on the lagoon, the reef flat, the seaward slope and the islands at Eniwetok. Man-made features that are evaluated include quarries which were excavated for building or road construction. A number of craters which remain from nuclear weapons testing are discussed.

45733 (DOE/EV/00703—T1-Vol.1, pp 37-56) **Geology and geohydrology of Enewetak Atoll.** Ristvet, B.L. (Maxwell Labs., Inc., Albuquerque, NM (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

Data are summarized on the geological aspects of Eniwetok gathered over the last 40 years. The history of investigations may be divided into three periods: pre-1946, 1946-1964 and post-1964. The first period was one of discovery and initial exploration, focusing on surficial geologic features. Beginning in 1946, there was a significant increase in knowledge of atolls resulting from a series of comprehensive scientific studies which established baselines to assess effects from nuclear weapons testing conducted at Eniwetok between 1946 and 1958. From 1964 to the present, scientific studies have been of two types: those which have continued to address the problems conceptualized by earlier studies and those which have addressed the effects of the nuclear weapons testing. Studies of the hydrology of Eniwetok were initiated in 1972 to evaluate possible environmental effects of the proposed PACE high explosive craters on the ground-water resources of the islands.

45734 (DOE/EV/00703—T1-Vol.1, pp 57-70) **Oceanography of Enewetak Atoll.** Atkinson, M.J. (Univ. of Western Australia, Nedlands). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

The author presents a general oceanography of the northern Marshall Islands and then focuses on the oceanography of Eniwetok Lagoon. Frequent comparisons are made between Eniwetok and Bikini. Windward and leeward cross-reef currents, channel currents, and tidal flow are the major factors influencing the exchange of water between atoll lagoons and the surrounding ocean. Wind-driven circulation contributes primarily to internal circulation. Upwelling of the windward side of lagoons may occur but does not seem to be a generalized feature of deep lagoon circulation. Deep water flow appears to orient itself toward the channels of net water output.

45735 (DOE/EV/00703—T1-Vol.1, pp 71-90) **Meteorology and atmospheric chemistry of Enewetak Atoll.** Merrill, J.T.; Duce, R.A. (Univ. of Rhode Island, Kingston (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

The authors discuss the various aspects of the weather of Eniwetok Atoll. The mean and variation for each observed quantity of interest are briefly covered and the authors note their state of knowledge of these factors. In relation to atmospheric chemistry of the atoll, the authors make use of the extensive data collected during experiments there in 1979.

45736 (DOE/EV/00703—T1-Vol.1, pp 91-138) **Subtidal environments and ecology of Enewetak Atoll.** Colin, P.L. (Univ. of Papua New Guinea, Port Moresby (Indonesia)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

Subtidal environments of Eniwetok are the lagoon and outer reefs and the passage between them which are submerged at low tides. The lagoon and outer reefs are separated, except at passes, by the intertidal reef flat. The outer slope of the atoll is different from the lagoon. The present discussion will include descriptive information on the outer slope to 300 to 400 m depth, but below those depths there is little detailed information concerning the biological communities or geological perspectives.

45737 (DOE/EV/00703—T1-Vol.1, pp 139-157) **Intertidal ecology of Enewetak Atoll.** Kohn, A.J. (Univ. of Washington, Seattle (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

The author summarizes the present state of knowledge of the ecology of intertidal environments at Eniwetok. Studies over the past 25 years have documented the major outlines of community organization and have revealed some important, unexpected characteristics. The knowledge these studies have provided of the identity of the major organisms present, their population densities, distribution patterns, temporal variations, habitat requirements, and trophic roles and interactions is evaluated. However, a satisfactory model of intertidal community structure and processes will require more intensive future studies.

45738 (DOE/EV/00703—T1-Vol.1, pp 159-179) **Reef processes: energy and materials flux.** Marsh, J.A. Jr. (Univ. of Guam, Mangilao). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

An overview is presented of the many studies that have been conducted at Eniwetok on reef community processes, making major contributions to an understanding of these processes. These studies have also influenced the context in which many ecologists think about reef systems. Attention is focused on community metabolism,

calcification processes at the ecosystem and organismal level, as well as nitrogen and phosphorus cycling. In addition, the role of detritus, coral nutrition, and ecological relationships of reef fishes are discussed.

45739 (DOE/EV/00703—T1-Vol.1, pp 181-186) **Trophic relationships in Enewetak Atoll.** Marshall, N.; Gerber, R.P. (Univ. of Rhode Island, Kingston (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

Some of the biologists who were attracted to Enewetak Atoll after the marine research laboratory opened have been studying species that are typical of reef environs and plentiful in this setting. Some have been interested in ecological features, particularly those of the well-developed windward reefs; and some, who have focused on the reef areas as an ecological subsystem, have been interested in the processes of the atoll as a whole. They start by noting three contrasting environments in this large, but typical, atoll. First, there are the coral reefs and knolls, the former almost completely enclosing the atoll, the latter scattered through the lagoon and numbering over 2000. Then there are the open waters of the lagoon. Finally, there is the lagoon benthic environment (other than the coral knolls). In a real sense, and in comparison with the rest, the reefs and knolls are very productive, even though the oceanic waters surrounding the atoll are low in nutrients and organic food sources.

45740 (DOE/EV/00703—T1-Vol.1, pp 187-202) **Terrestrial environments and ecology of Enewetak Atoll.** Reese, E.S. (Univ. of Hawaii, Honolulu (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

The terrestrial ecosystem of Enewetak Atoll is the result of the dynamic interaction between the biota associated with the small dry land area and physical parameters of the environment, especially the climate, soil, and ground water. The shrubs and trees, man, birds, rats, and land crabs are among the more conspicuous elements of the terrestrial biota, whereas climatic events, the soils, and the availability of ground water are the most important physical components of the ecosystem.

45741 (DOE/EV/00703—T1-Vol.1, pp 203-214) **Biology of the rodents of Enewetak Atoll.** Jackson, W.B.; Vessey, S.H.; Bastian, R.K. (Bowling Green State Univ., OH (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

Roof rats and Polynesian rats, introduced to the atoll by 20th Century commerce and the Micronesians, respectively, were present allopatrically on the larger islets. Of necessity, they were largely vegetarians. Reproductive cycles were keyed to rainfall patterns. High density populations had high stress indices, including high parasite loads. The rats, at the top of the terrestrial food pyramid, constituted a bioenvironmental monitor that was rarely utilized during the several test programs. Bioconcentration of radioisotopes, especially ^{137}Cs and ^{60}Co, occurred; rats implanted with dosimeters were determined to function as environmental radiation monitors. They hypothesized that roof rats on Enjebi survived the nearby nuclear detonation. Analysis of plasma transferrins indicated greater heterozygosity in the northern atoll rat populations. The incidence of oral palatal ridge deformations also was positively correlated with environmental radiation levels, but other gross indications of radiation effect were not found.

45742 (DOE/EV/00703—T1-Vol.1, pp 215-220) **Avifauna of Enewetak Atoll.** Berger, A.J. (Univ. of Hawaii, Honolulu (USA)). 1987. NTIS, PC A11/MF A01. Order Number DE87006110/JAW.

In The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.

About 41 species of birds have been recorded at Eniwetok. The birds that have arrived there have had to be strong fliers. Many of the native seabirds are species that have a vast range in the Pacific region, and many of them spend only the breeding season on land. At least 12 species are known to breed on the atoll, and at least four other species are thought to nest there. Many other birds probably include Eniwetok within their range.

45743 (PNL-SA—14776) **Comparisons among species composition, leaf area, and water relations in three shrub-steppe plant communities.** Link, S.O.; Kirkham, R.R.; Thiede, M.E.; Downs, J.L.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013118/JAW.

Observations were made on plant communities dominated by Bromus tectorum (cheatgrass site), Artemisia tridentata (sagebrush site), and Grayia spinosa (hopsage site). Leaf area on a ground area basis of sagebrush was nor significantly different between the sagebrush and hopsage sites; however, the leaf area of hopsage was one-quarter that of sagebrush at the hopsage site. Pre-dawn xylem water potential of sagebrush was -2.91 MPa, while that of hopsage was -4.79 MPa. Stomatal conductance and transpiration rate of sagebrush and hopsage were nearly the same. 11 refs., 4 figs., 2 tabs.

5106 Regulations

45744 (PB—88-204284/XAB) **Case-studies addendum: 1-8. Remedial response at hazardous-waste sites. Final report, December 1984-September 1985.** Furman, C.; Cochran, S.R.; Dower, R.; Yang, E. (Science Applications International Corp., McLean, VA (USA)). Apr 1988. 515p. NTIS, PC A22/MF A01.

See also PB—85-121721.

In response to the threat to human health and the environment posed by numerous uncontrolled hazardous-waste sites across the country, new remedial-action technologies are evolving and known technologies are being retrofitted and adapted for use in cleaning up these sites. The report identifies and assesses various types of site-response activities that have been implemented, are in progress, or have been proposed to date at Superfund-financed and enforcement action hazardous waste sites in the United States. A nationwide survey was conducted in which 30 uncontrolled hazardous waste sites were identified where either some form of enforcement action was planned or where remedial actions were Superfund-financed. Based on an assessment of the 30 sites, eight sites were selected for which detailed case-study investigations have been conducted. The document presents case-study reports for each of the eight sites. These reports include extensive discussions of the remedial responses at each of the eight sites with respect to technology, cost, and institutional framework.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 45790

45745 (AD-A—192255/8/XAB) **Ion and electron interactions of atmospheric importance. Final report, 1 July 1986-30 November 1987.** Smith, D.; Adams, N.G. (Birmingham Univ. (UK). Dept. of Space Research). 31 Dec 1987. 82p. NTIS, PC A05/MF A01.

The variable-temperature flowing afterglow/Langmuir probe (VT-FALP) and the variable-temperature selected-ion-flow drift-tube (VT-SIFDT) apparatuses were exploited to study: (i) dissociative electron attachment to HBr and HI and reverse processes of associative detachment of Br^- and I^- with H atoms; (ii) secondary dissociative electron-attachment reactions of the radicals CCl_3 and CCl_3Br formed in the primary dissociative electron-attachment reactions of CCl_4 and CCl_3Br(iii) dissociative recombination reactions of several positive ion species; and (iv) the ternary association reactions of CH^{3+} ions with H_2, N_2 and CO as a function of the centre-of-mass interaction energy.

45746 **(NP—8770335) Labelling of algae and inorganic sediments with neutron-activable indicator elements and fluorescence dyes.** Schulze, E. (Hannover Univ. (Germany, F.R.). Fachbereich Biologie). 15 Apr 1986. 124p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770335/JAW.

For an investigation of algae sinking characteristics in natural bodies of water, three different species (Chlorella fusca, Scenedesmus quadricauda, Nostoc variabilis) were labelled with neutron-activable elements. The rare earths Dy, Er, and Eu were preferred for their rare natural occurrence and favourable activation analysis characteristics. Growth and enrichment were monitored using a method of chlorophyll fluorescence measurement which enables measurements of the chlorophyll concentration and photosynthetic activity. After sampling, the suspensions were filtered and activated with thermal neutrons in a research reactor. The indicator masses were determined by a quantitative evaluation of the γ spectra. In parallel to these investigation, labelling with fluorescent dyes was investigated. The transport characteristics of phosphate-carrying aggregates of the coarse clay fraction, glasses containing Dy, Eu and Er were prepared and fractionated in a centrifugal ball mill to obtain an earth with near-natural grain size distribution. The applicability of the labelling and detection methods developed for the dissertation was tested in a natural environment. Limits of application and costs were assessed.

45747 **(PB—88-205463/XAB) Waste characterization study for the Kemp's Ridley sea turtle. Technical memo.** Malone, R.F.; Guarisco, M. (National Marine Fisheries Service, Galveston, TX (USA). Galveston Lab.). Feb 1988. 45p. (NOAA-TM-NMFS-SEFC—200). NTIS, PC A03/MF A01.

See also PB—86-105178.

The Kemp's Ridley sea turtle, Lepidochelys kempi, is an endangered species. The National Marine Fisheries Service's Head Start program is part of an international operation to save the turtles from extinction. Under the Head Start program, eggs from the Ridley's only known wild nesting beach at Rancho Nuevo in Mexico are transported to Padre Island on the Texas coast to be hatched. The head start enables the turtles to develop a survival advantage. The principal objective was to develop baseline waste-characterization data required to design a waste-water treatment scheme for the Galveston Head Start facility. As a secondary objective, preliminary testing of some filtration components was undertaken to determine which units were most appropriate for inclusion in a wastewater treatment scheme.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 44771, 45452, 45652, 45677, 45683, 45712, 45713, 45719, 45738, 45873

45748 **(AD-A—192375/4/XAB) Installation-Restoration Program. Phase 2, Confirmation/quantification. Stage 2, Elmendorf Air Force Base, Alaska. Final report, 30 July 1986-23 July 1987.** (Dames and Moore, Park Ridge, IL (USA)). 1 Mar 1988. 545p. NTIS, PC A23/MF A01.

Twelve sites were investigated at Elmendorf AFB during the Phase II, Stage 2 field evaluation of the IRP. The sites were investigated through the drilling, installing, and sampling 11 new monitor wells, three base water-supply wells, and four surface-water samples. Two ground-water systems exist beneath the base, and they are typically separated by a thick clay unit. The depth-to-water table varies from zero to as much at 50 to 60 feet. The shallow aquifer was contaminated in the past and is vulnerable to future contamination, but the deeper aquifer is not in significant danger. The principal source of water for the base and the adjacent City of Anchorage is surface water upstream of the base; makeup wells generally extend to the deep aquifer.

45749 **(AD-A—192780/5/XAB) Biotransformation of hazardous organic pollutants. Final report, 1 August 1986-1 August 1987.** Bouwer, E.J. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Geography and Environmental Engineering). 2 Feb 1988. 3p. NTIS, PC A02/MF A01.

When growing on methane and oxygen, methanotrophic bacteria possess a non-specific enzyme, methane monooxygenase, that has been shown to oxidize halogenated solvents in cell extracts. Methanotrophic bacteria were cultured in batch and column reactors to test their ability to oxidize a number of organic contaminants. Transformation pathways and rates will be determined using the instrumentation funded by OSR. The fundamental concepts derived from laboratory experiments and data are being formulated into a computer biofilm model to predict regions in a contaminated subsurface where the proper environment occurs for contaminant biotransformation. This model will aid the design of biological in-situ treatment processes that hold promise to permanently clean up contaminated aquifers.

45750 (CONF-871075—Vol.1-Pt.3, pp 449-457) **Investigations to determine the origin of toxic constituents in ORGDP liquid effluents.** McGaha, M.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The National Pollutant Discharge Elimination System (NPDES) permit for the Oak Ridge Gaseous Diffusion Plant contains requirements for a Biological Monitoring Plan and Abatement Program for the surface stream above the K-1700 discharge point as well as a Toxicity Control and Monitoring Program for the discharges from listed outfalls. Toxicity tests are conducted at the Oak Ridge National Laboratory according to Environmental Protection Agency protocols using sensitive aquatic organisms. In support of these programs, portions of water samples have been retained for laboratory analysis of constituents which might contribute to observed toxicity. This presentation describes efforts underway to correlate toxicity observations with water quality data and investigations to identify process and area source discharges from which toxic constituents originate. The feasibility of potential long-term measures to ensure acceptable test results will also be discussed.

45751 **(EPRI-EA—5742-CCM) The FOssil Fuel Combustion Waste Leaching (FOWL{trademark}) code: Version 1, User's manual.** Hostetler, C.J.; Erikson, R.L.; Rai, D. (Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 105p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88013251/JAW.

This document is a technical reference and user's manual for Version 1.12 of the FOssil Fuel Combustion Waste Leaching (FOWL{trademark}) code. Version 1.12 is the first release version of the FOWL{trademark} code. Currently, the FOWL{trademark} code contains an interim model for the calculation of quantities, aqueous concentrations, and release durations of selected inorganic elements leached from fossil-fuel combustion residues. Aqueous concentrations in leachates are calculated from mechanistic thermochemical data for Al, Ba, Ca, Cr, Mo, S, Si, and Sr. These constituents have been shown experimentally to be controlled by specific solubility-limiting solids contained in fossil fuel wastes. In addition, the code calculates concentrations of As, B, Cd, Cu, Fe, Mg, Na, Ni, Se, and Zn using empirical relationships derived from experimental observations of aqueous concentrations as a function of pH for fossil-fuel combustion residues. The leaching chemistry calculation is combined with a water-balance calculation to predict leachate quality and quantity as a function of time for a landfill or pond of known geometry. This user's manual describes the development of the geochemical conceptual model included in the FOWL{trademark} code, the algorithms used to simulate the leaching process, and step-wise instructions for using the code. An example problem and results are also included. 6 refs., 40 figs., 10 tabs.

45752 (IVA—310, pp 45-53) **Effects on soil and ground water of acid precipitation corrosion and contamination of drinking water.** Broemssen, U. von. (National Swedish Environment Protection Board, Solna (Sweden). Dept. of Research and Development). 1986. NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW. (STYFF—13; CONF-8506392—).

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

This paper gives a review over the drinking water quality in Sweden. Long term changes in ground water chemistry is summarized. Ongoing research on acidification of soil and ground water in Sweden is accounted for. An action program against air pollution and acidification drawn up by the National Environmental Protection Board is presented. This program is intended to serve as a basis for decisions by the Swedish Government on further environmental policy measures in this field. (BoK).

45753 **(IVL-B—837) Oil pollution from rivers.** Kaj, L.; Lehtinen, C. (Swedish Environmental Research Inst., Stockholm). Nov 1986. 39p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88753695/JAW.

Concentrations of petroleum hydrocarbons in ten Swedish rivers have been measured. Total emission of hydrocarbons to Swedish coastal waters is estimated at 2000-2900 ton/year (GC-analysis) and 2500-3800 ton/year (fluorimetric analysis). (authors).

45754 **(NP—8770243) Modelling of large-scale heat and contaminant transport in ground water. DFG Research Group at the Universities of Hohenheim, Karlsruhe and Stuttgart - report of activities 1986/1987.** Kobus, H. (ed.). (Stuttgart Univ. (Germany, F.R.). Inst. fuer Wasserbau). 1987. 242p. (In German). NTIS (US Sales Only), PC A11. Order Number DE88770243/JAW.

The object of the investigation is to work out general lines for calculating the transport of heat and of constituents in aquifers, test these on specific examples and employ them in drawing up concepts for the sanitation, management, and protection of aquifers. On the basis of the flow-mechanical, hydrological, physical, and chemical fundamentals of material transport, a general model concept is developed, which must be compatible particularly with the type of nature data available, to be suitable for practical use. Within this framework, fully developed models are to be devised for the transport of heat, chlorinated hydrocarbons and nitrates. The theoretical, numerical, and experimental investigations needed for this have been continuously, from the beginning, based on nature observations on the occasion of topical events. (orig./HP)

45755 **(PB—88-199427/XAB) Shake-flask test for estimation of biodegradability of toxic organic substances in the aquatic environment.** Cripe, C.R.; Walker, W.W.; Pritchard, P.H.; Bourquin, A.W. (Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab.). 1987. 15p. (EPA—600/J-87/330). NTIS, PC A03/MF A01.

Pub. in Ecotoxicology and Environmental Safety, Vol. 14, 239-251(1987).

The disadvantages of current biodegradation tests are examined. These problems include need for high substrate concentrations, lack of parent-compound concentration measurements and estimation of sediment effects, failure to indicate compounds to which microbial populations must adapt to degrade, and lack of site specificity in innocula selection. A modified river die-away test is proposed for determining biodegradability of organic compounds and testing for toxic degradation products. The chemical-abatement test uses shake flasks containing sterile and nonsterile site water, both with and without site sediment. Concurrent toxicity testing with mysids or daphnids provides a sensitive assay for the detection of toxic metabolites.

45756 **(PB—88-200522/XAB) Design of innovative flotation-filtration waste-water treatment systems for a nickel-chromium plating plant. Technical report.** Wang, L.K. (Lenox Inst. for Research, Inc., MA (USA)). Jan 1984. 40p. (LIR—01-84/65). NTIS, PC A03/MF A01.

See also PB—86-179132.

The specific purpose of the report is to describe the chemical and physical methods incorporated in the pretreatment system, describe the modifications that will be made to improve the wastewater treatment system, and to relate the methods and modifications to the operation of the total system. Special emphasis of the report is placed on presentation of: (a) detailed chemistry of nickel-chromium plating wastewater treatment; (b) conventional reduction-precipitation treatment system; (c) modified reduction-flotation treatment system; and, (d) innovative flotation-filtration treatment systems.

45757 **(PB—88-202072/XAB) Four independent approaches to developing sediment-quality criteria yield similar values for model contaminants.** Chapman, P.M.; Barrick, R.C.; Neff, J.M.; Swartz, R.C. (Environmental Protection Agency, Newport, OR (USA). Environmental Research Lab.). 1987. 5p. (EPA—600/J-87/342). NTIS, PC A02/MF A01.

Pub. in Environmental Toxicology and Chemistry, Vol. 6, 723-725(1987).

Separate approaches to determining marine sediment-quality criteria yielded similar values for three contaminants. These values, including concentrations at or below which biological effects have been shown to be minimal and lowest concentrations at which biological effects have been shown to occur, range from (dry weight sediment): lead, 50 to 300 micrograms/g (ppm); polyaromatic hydrocarbons, 2.0 to 12.0 micrograms/g; polychlorinated biphenyls, 0.06 to 0.13 micrograms/g.

45758 **(PB—88-202619/XAB) Modeling transient-groundwater flow in multilayered aquifer systems. Technical report.** Aral, M.M.; Haddad, E.H. (Georgia Inst. of Tech., Atlanta (USA). Environmental Resources Center). Apr 1987. 77p. (ERC—05-87). NTIS, PC A05/MF A01.

Also pub. as Georgia Inst. of Tech., Atlanta. School of Civil Engineering rept. no. SCEGIT-86-144.

This study is directed toward gaining additional knowledge on the unsteady performance of multilayer aquifers in response to heavy withdrawal of water from several wells distributed in the system. A recent status report on ground-water problems in South Eastern United States clearly indicates that more-detailed information is needed on this problem in order to describe appropriate management options for such multilayer aquifer regions. The study extends the steady-state model to an unsteady multilayer groundwater flow model that prepares the stage for contaminant transport model in multilayer aquifers which is the last phase of these model-development efforts.

45759 **(PB—88-203468/XAB) Inorganic and organic micro pollutants in industrial waste water.** van Starkenburg, W.; van Luin, A.B. (Ministerie van Verkeer en Waterstaat, The Hague (Netherlands). Afdeling Emmissie-Onderzoek). Dec 1985. 68p. (In Dutch). (REPT—8611). NTIS, PC E04/MF A01.

In 1983 and 1984 research was conducted on the presence of a number of environment polluting substances in industrial waste water. The study was set up as a result of an Order in Council draft concerning the inventory of substances. This draft stipulated that a number of environmental pollutants be measured in all waste water streams. The RIZA (expansion not known) conducted a pre-inventory in order to check to which extent substances occur in waste water from a large number of industries. Substances of the following groups were checked: heavy metals, drifs, PCB, chlorine phenols, benzene and chlorinated benzenes, tri- and tetrachloro-methane. The study has thrown light on the presence of these substances in the waste water of a number of industries. A striking find was the frequent occurence of chlorine phenols in waste water streams.

45760 **(PB—88-205323/XAB) Kinetic models for design and control of activated-sludge plants. Part 1.** van der Heide, J. (Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering). Feb 1987. 43p. (In Dutch). NTIS, PC E03/MF A01.

See also PB—88-205331.

A model that describes the desired effluent quality in terms of BOD or COD as a function of waste-water characteristics and

process parameters can be of great importance to the design and operation of activated-sludge treatment plants. The so-called kinetic models are based on the kinetics of the substrate removal and sludge growth that occur in the aeration tank of an activated-sludge process, either under steady-state or dynamic conditions. In the report an overview is given of the relative simple Monod and first-order kinetics, including some modifications.

45761 **(PB—88-205331/XAB) Kinetic models for design and control of activated sludge plants). Part 2. Figures, symbols, formulae and tables.** van der Heide, J. (Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering). Feb 1987. 81p. (In Dutch). NTIS, PC E04/MF A01.

See also PB—88-205323.

The report includes kinetic models for the design and control of activated-sludge sewage-treatment plants.

45762 **(PB—88-212527/XAB) Evaluation of biological treatment of pharmaceutical waste water with PAC (powdered activated carbon) addition. Volume 1. Final report.** Gardner, D.A.; Osantowski, R.A. (Radian Corp., Milwaukee, WI (USA)). May 1988. 215p. NTIS, PC A10/MF A01.

See also Volume 2, PB—88-212535.

A lack of information on applicable removal technologies for total chemical oxygen demand (TCOD) prevented promulgation of best available technology economically achievable (BAT) limitations and new source performance standards (NSPS) for TCOD for pharmaceutical manufacturing plants in 1983 (EPA/440/1-83/084). One technology that was evaluated was powdered activated carbon (PAC) addition to an activated-sludge system (PACT®). A viscous floating mass of mixed-liquor solids (VFMLS) developed in the PACT units and resulted in premature termination of the study. The purposes of the study were to: (1) attempt to find the cause of the formation of the VFMLS; (2) generate additional research data for TCOD removal from pharmaceutical waste water using the PACT process; (3) evaluate the efficiency of PACT in removing specific organics; (4) evaluate the effectiveness of PACT in reducing effluent aquatic toxicity and (5) evaluate the use of a selector to improve the settleability of the mixed liquor. One control unit, two PACT units and a unit equipped with a series of selector basins for improving the settling characteristics of the mixed-liquor suspended solids were operated.

45763 **(PB—88-212535/XAB) Evaluation of biological treatment of pharmaceutical wastewater with PAC (powdered activated carbon) addition. Volume 2. Appendices. Final report.** Gardner, D.A.; Osantowski, R.A. (Radian Corp., Milwaukee, WI (USA)). May 1988. 348p. NTIS, PC A15/MF A01.

See also Volume 1, PB—88-212527.

A lack of information on applicable removal technologies for total chemical oxygen demand (TCOD) prevented promulgation of best available technology economically achievable (BAT) limitations and new source performance standards (NSPS) for TCOD for pharmaceutical manufacturing plants in 1983 (EPA/440/1-83/084). Therefore, in 1984 EPA conducted a pilot-plant study of activated-carbon-treatment technologies utilizing pharmaceutical waste waters from a manufacturing plant that produces fermentation products (Subcategory A) and chemical synthesis products (Subcategory C). The purposes of the study were to: (1) attempt to find the cause of the formation of the VFMLS; (2) generate additional research data for TCOD removal from pharmaceutical wastewater using the PACT process; (3) evaluate the efficiency of PACT in removing specific organics; (4) evaluate the effectiveness of PACT in reducing effluent aquatic toxicity; and, (5) evaluate the use of a selector to improve the settleability of the mixed liquor. One control unit, two PACT units and a unit equipped with a series of selector basins for improving the settling characteristics of the mixed-liquor suspended solids were operated.

45764 **(PB—88-213079/XAB) Biological waste-water treatment of azo dyes.** Shaul, G.M.; Dempsey, C.R.; Dostal, K.A. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). May 1988. 7p. (EPA—600/D-88/084). NTIS, PC A02/MF A01.

The U.S. Environmental Protection Agency's (EPA) Office of Toxic Substances evaluates existing chemicals under Section 4 of the Toxic Substances Control Act (TSCA) and Premanufacture Notification (PMN) submissions under Section 5 of TSCA. Azo dyes constitute a significant portion of these PMN submissions and specific azo dyes have recently been added to the priority list for considerations in the development of test rules under Section 4. Azo dyes are of concern because some of the dyes, dye precurors, and/or their degradation products such as aromatic amines (which are also dye precurors) have been shown to be, or are suspected to be, carcinogenic. The fate of azo dyes in biological waste-water treatment systems was studied to aid in the review of PMN submissions and to assist in the possible development of test rules. Results from extensive pilot-scale activated-sludge process testing for 18 azo dyes are presented. Results from fate studies of C.I. Disperse Blue 79 in aerobic and anaerobic waste-water treatment will also be presented.

45765 **(PB—88-213996/XAB) Maryland synoptic stream chemistry survey: estimating the number and distribution of streams affected by or at risk from acidification. Final report, November 1986-April 1988.** Heimbuch, D.G.; Greening, H.S.; Filbin, G.J. (International Science and Technology, Inc., Reston, VA (USA)). Apr 1988. 217p. NTIS, PC A10/MF A01.

See also PB—87-198412.

The survey was designed to provide statewide estimates of the number and extent of stream resources presently affected by or at risk from acidification. Streams surveyed were selected as a stratified random sample from a statewide list of non-tidal stream reaches. The sample represented water-quality conditions in a population of interest comprising the state's headwater stream resources sampled during relatively constant phenological conditions during the spring of 1987. Of the 6875 non-tidal stream reaches in the state, an estimated 5411 stream reaches belong to the population of interest. Volunteers collected water samples from 559 randomly selected and 71 special interest reaches statewide. Samples were analyzed for acid-neutralizing capacity (ANC), pH, conductivity, dissolved organic carbon (DOC), color, and dissolved inorganic carbon (DIC), using analytical methods developed for the EPA National Surface Water Survey.

45766 **(PB—88-214739/XAB) Fate of dyes in aquatic systems. 1. Solubility and partitioning of some hydrophobic dyes and related compounds.** Baughman, G.L.; Perenich, T.A. (Georgia Univ., Athens (USA)). 1988. 20p. NTIS, PC A03/MF A01.

Pub. in Environmental Toxicology and Chemistry, Vol. 7, No. 3, 183-199(Mar 1988).

Solubilities and vapor pressures from the literature are combined with calculated octanol/water partition coefficients, K (sub ow), to assess the expected environmental behavior of about 50 dyes. The solubility suggests the potential for a 30- to 150-fold concentration enhancement in sediments and bioconcentration of about 1,000 times in the absence of metabolism. The data also indicate that solubilities computed from K (sub ow) for disperse dyes is 10 to 100 times smaller than reported for most other compounds. Henry's Law constants calculated from solubility and vapor pressure show that the disperse and vat dyes will be entirely gas-phase-controlled in their rate of volatilization from water and that the process will be extremely slow. No definitive conclusions can be drawn about the behavior of more recently developed disperse dyes. The available physical constants are compiled along with structures, Color Index numbers, CAS numbers, and names for 80 compounds.

45767 **(PB—88-218391/XAB) Abiotic transformations of toxic organic chemicals in the liquid phase and sediments.** Wolfe, N.L. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). Jun 1988. 27p. (EPA—600/D-88/120). NTIS, PC A03/MF A01.

Analyses of selected ground-water data bases provide insight into the abiotic reaction conditions that occur in subsurface ecosystems. With this information it is possible to impose boundaries on the activity of selected chemical species in porous media and narrow the ranges of reactivities to be studied in quantifying abiotic transformation processes. The ground-water parameters that are addressed here are, pH, oxygen levels, and organic carbon content.

These data suggest that neutral or pH-independent hydrolysis would be the more-important process for many organic compounds in ground-water systems than would alkaline or acid-hydrolysis pathways. Also the data suggest that, for abiotic redox transformation reactions of organic compounds, reductive processes would be more important. Based on the knowledge of the kinetics of abiotic hydrolysis of selected organic compounds in soil and aquifer samples, it appears that sorption affects the observed hydrolysis rate constant depending on the hydrolytic pathway.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 44708, 44766, 44771, 44789, 44819, 45055, 45070, 45866

45768 **(AERE-R—12061) Studies of environmental radioactivity in Cumbria. Pt. 8. Plutonium and americium in the intertidal sands of North-West England.** Eakins, J.D.; Morgan, A.; Baston, G.M.N.; Pratley, F.A.; Yarnold, L.P.; Burton, P.J. (UKAEA Harwell Lab. Environmental and Medical Science Div.). Mar 1988. 29p. H.M. Stationery Office, London, price Pound 4.00.

Sand cores and surface sand samples have been collected from the sea-facing intertidal regions of West Cumbria, between Silloth and Walney Island. Sand cores were also taken from the Duddon estuary and Morecambe Bay. The samples were collected between June 1983 and March 1984 and have been analysed for / sup 238/Pu, /sup 239+240/Pu and /sup 241/Am. The integrated deposits of /sup 239+240/Pu and /sup 241/Am in intertidal sand between Silloth and Walney Island were about 4.2 and 7 TBq respectively. Combined, this represents about 1% of the total alpha-emitting actinide activity discharged from Sellafield to sea up to 1982; the corresponding value for the Duddon Estuary is about 0.3%. The actinide levels observed are compared to those of natural alpha emitters in intertidal sand. Only on beaches close to Sellafield did levels of discharged alpha emitters exceed those of natural alpha-emitting nuclides. In the vicinity of Sellafield, the annual dose to man from the inhalation of resuspended intertidal material is certainly less than 50 μSv (committed effective dose equivalent) and may be substantially lower.

45769 **(ANSTO/E—661) ANSTO Tritium list No. 1: 1985-1986.** Calf, G.E.; Stokes, R.C. (Australian Nuclear Science and Technology Organisation, Lucas Heights). Aug 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702836/JAW.

Details are given of the concentration of the environmental radioisotope, tritium, in monthly precipitation samples taken during the period 1985-1986, at eleven stations throughout Australia. Tritium levels in Australian rainfall have been estimated for seventeen years and published first as reports of the Australian Atomic Energy Commission and now of the Australian Nuclear Science and Technology Organisation.

45770 (CONF-871075—Vol.1-Pt.3, pp 165-184) **Application of fixed bed trapping technology for removal of low concentration UF_6 from plant gaseous effluent streams.** Russell, R.G. (Paducah Gaseous Diffusion Plant, KY (USA)). 1987. NTIS, PC A18/MF A01. Order Number DE88007805/JAW. Contract AC05-84OR21400.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

A major concern and responsibility of the uranium enrichment enterprise is the protection of the environment from uranium contamination. The best available technology is being used to successfully minimize cascade light gas vent stream uranium emissions at Paducah. Experimental work is being performed to apply and expand trapping technology to different sources of emissions with various gas composition, pressure, and superficial velocity constraints. The performance of two trapping media - sodium fluoride (NaF) and alumina (Al_2O_3), objectives, test method, and conclusions will be discussed. Approximately 50 experimental runs have been completed to date with the following major conclusions: velocity has an effect on uranium loading on alumina, but UF_6 concentration does not; the UF_6 outlet concentration prior to breakthrough has been measured to be as low as < 1 ppb; higher trap loadings occur at lower pressure and superficial mass velocity; higher uranium loading occurs with Al_2O_3 until breakthrough, after which NaF experiences more loading; and Al_2O_3 is more efficient than NaF at higher velocities.

45771 **(INIS-BR—1131) Isotopic and chemical models for determining evaporation and percolation rates of dams.** Santiago, M.M.F. (Ceara Univ., Fortaleza (Brazil). Dept. de Fisica). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703231/JAW.

45772 **(INIS-BR—1132) Oxygen-18 in the parameter determination of a ground aquifer.** Frischkorn, H. (Ceara Univ., Fortaleza (Brazil)). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A01/MF A01. Order Number DE88703232/JAW.

45773 **(INIS-mf—11217) Radioactivity monitoring of the Irish marine environment 1985-1986.** Cunningham, J.D.; O'Grady, J.; Rush, T. (Nuclear Energy Board, Dublin (Ireland)). Jan 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702872/JAW.

This report presents the results of the monitoring programme for the two-year period from January 1985 to December 1986. Information on the radioactive contamination of the marine environment is obtained from the analysis of environmental samples taken at a number of locations along the coastline and various sampling stations in the western Irish Sea. These usually include samples of surface seawater, sediment, seaweed, fish and shellfish. Estimates are presented of the individual and collective doses received by the Irish public from the consumption of fish and shellfish during the period 1985-1986. These doses are assessed in terms of the system of dose limitation recommended by the International Commission on Radiological Protection and embodied in the Basic Safety Standards Directive of the European Community.

45774 **(PB—88-212105/XAB) Low-level and narm radioactive wastes. Model documentation: accounting model for PRESTO-EPA-POP, PRESTO-EPA-DEEP, and PRESTO-EPA-BRC. Methodology and users manual. Final report.** Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 115p. (EPA—520/1-87/029). NTIS, PC A06/MF A01.

See also PB—88-212139.

The accounting model was used as a utility model for assessing the cumulative health effects to the general population residing in the downstream regional water basin as a result of the disposal of LLW when a unit response analysis method is used. The utility model is specifically designed to assess the cumulative population health effects in conjunction with the PRESTO-EPA-POP, PRESTO-EPA-BRC, or PRESTO-EPA-DEEP model simply for the purpose of reducing the cost of analysis. Therefore, the assessment of the cumulative population health effects may also be conducted with one of the above appropriate models without the aid of this accounting model.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 45754

45775 **(BHRA—88/05/XAB) Estimation of the net heat flux on water surfaces.** Pollard, G.J. (British Hydromechanics Research Association, Cranfield). Feb 1984. 35p. (TN—2148). NTIS PC$45.00.

The net heat flux on a water surface is considered as a sum of its component parts, and an expression for each component is provided and its derivation explained. Components analyzed include solar radiation, atmospheric radiation, water surface radiation, and evaporative and conduction heat flux. The normal range of values of each component are tabulated, and worked examples are provided to illustrate the use of the expressions for a water surface in the field, and to gain some idea of the environmental effect of waste-heat disposal.

45776 **(CRIE-U—87046) Effect of temperature on zostera marina L. (Part 3) Change of the lifecycle by a rise in temperature.** Kawasaki, Yasuo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 26p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753866/JAW.

In order to obtain a basic knowledge to predict the influence of thermal effluent to the eelgrass beds, indoor experiment was made to use the influence on the life cycle of of the eelgrass taking Odawa Bay as a model site. Results are as follows. 1. Seed germination was retarded by temperature increase and the germination rates at temperature +6°C (min. water temperature 18°C) reduced. 2. Survival rate of transplants at temperature +3°C in summer experiment (max. water temperature 29°C) and +9°C in winter (min. temperature 21°C) experiment were significantly lower than control. All of shoots died at temperature +6°C in summer experiments. 3. The change of vegetative shoots to flowering shoots was inhibited by a temperature rise of +3°C (min. water temperature 15°C). From these results, we inferred that the life cycle of Zostera in Odawa Bay will be affected when temperature increases by +3°C or greater both in summer and winter. (16 figs, 3 tabs, 15 refs)

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 45106, 45107, 45730, 45731, 45732, 45733, 45734, 45735, 45736, 45737, 45739

45777 **(PB—88-201967/XAB) Summary of the Black Creek Project: report through 1980 project year based on seminars in Washington, D.C., February 1980, Chicago, Illinois, March 1980. Progress report.** Morrison, J.B.; Nelson, D.; Mannering, J.V.; Griffith, D.; Beasley, D.B. (Allen County Soil and Water Conservation District, Fort Wayne, IN (USA)). Jun 1981. 69p. NTIS, PC A04/MF A01.

See also PB—80-134059.

This is a progress report of the Black Creek sediment-control project. The Black Creek watershed is located in the Maumee River Basin and drains into the western end of Lake Erie in Indiana. The report discusses the details of the work done in water-quality management and ongoing research for planning at the national, regional or state level. The Black Creek project exemplifies the traditional approach, and its shortcomings in improving and maintaining biological integrity are the same as, or similar to, those of other traditional projects.

5206 Regulations

REFER ALSO TO CITATION(S) 45744

45778 **(PB—88-204003/XAB) Superfund Record of Decision (EPA Region 1): Re-Solve, Inc. Site, North Dartmouth, Massachusetts (second remedial action), July 1987. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 24 Jul 1987. 230p. (EPA/ROD/R—01-87/023). NTIS, PC A11/MF A01.

See also PB—85-213627; Portions of this document are not fully legible.

The Re-Solve, Inc. site is a former waste-chemical reclamation facility situated on six-acres of land in North Dartmouth, Massachusetts. Bounded by wetlands to the north and east, the land surrounding the site is predominantly zoned for single-family residential use. All residences obtain their water from private wells located on their property. The Copicut River, located about 500 feet from the site, has been designated for protection. Between 1956 and 1980, Re-Solve, Inc. handled a variety of hazardous materials including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids and PCBS. Residues from the distillation tower, liquid sludge waste, impure solvents and burnt tires were disposed of in four onsite unlined lagoons. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. In 1974 the Massachusetts Division of Water Pollution Control issued Re-Solve, Inc. a license to collect and dispose of hazardous waste. In December 1980 the Massachusetts Division of Hazardous Waste agreed to accept Re-Solve's offer to surrender its disposal license.

45779 **(PB—88-213541/XAB) Supplemental development document for effluent-limitations guidelines and standards for the leather tanning and finishing, Point source category. Final report.** Gile, R.R. (Environmental Protection Agency, Washington, DC (USA). Office of Water Regulations and Standards). Feb 1988. 105p. (EPA—440/1-88/016-S). NTIS, PC A06/MF A01.

See also PB—83-172593.

EPA amended 40 CFR Part 425 which limits effluent discharges to waters of the U.S. and the introduction of pollutants into publicly owned treatment works (POTW) by existing and new sources engaged in leather tanning and finishing. EPA agreed to promulgate these amendments in a settlement agreement with the Tanners' Council of America, Inc. The agreement settles a dispute between the Council and EPA that was the subject of a petition for judicial review of the final leather tanning and finishing regulation promulgated by EPA on November 23, 1982 (47 FR 52848). The document describes the technical development of these amendments which include: (1) a new analytical method for the determination of the presence of sulfide in wastewater for use in the Hair Save or Pulp, Non-Chrome Tan, Retan-Wet Finish Subcategory; (2) clarification of procedural requirements for POTW to follow in determining whether sulfide pretreatment standards are applicable; (3) revisions to certain of the effluent limitations guidelines for best practicable control technology currently available (BPT) and new source performance standards (NSPS).

45780 **(PB—88-214267/XAB) Alternate Concentration Limit guidance, based on 264.94(B) criteria, Part 2. Case studies. Interim report (Final).** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). May 1988. 560p. (EPA—530/SW-87/031). NTIS, PC A24/MF A01.

See also Part 1, PB—87-206165.

These case studies constitute Part II of the ACL Guidance Document. They are intended to assist Regional and State personnel in exercising the discretion conferred by regulation in evaluating applications for alternate concentration limits (ACLs) submitted pursuant to 40 CFR 264.94. The document is not a regulation and should not be used as such. Regional and State personnel must exercise their discretion in using this guidance document as well as other relevant information in determining whether an ACL demonstration meets the regulatory standard.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

45781 **(INIS-XN—3) Circular of 27 September 1985 concerning Decrees Nos. 85-448, 85-449, 85-450, 85-452, 85-453 of 23 April 1985 and No. 85-693 of 5 July 1985 made in implementation of the Act of 12 July 1983 on democratisation of public inquiries and environmental protection.** (Nuclear Energy Agency, 75 - Paris (France)). 28 Sep 1985. 3p. (In French). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE87780063/JAW.

This circular defines the workings of the various Decrees made in implementation of the 1983 Act on democratisation of public inquiries. (NEA)

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 45108

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 45797, 45810, 45811, 45812, 45838

45782 **(AD-A—192861/3/XAB) T-2 mycotoxin inhibits mitochondrial protein synthesis.** Pace, J.G.; Watts, M.R.; Canterbury, W.J. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). 1988. 9p. NTIS, PC A02/MF A01.

Pub. in Toxicon, Vol. 26, No. 1, 77-85(1988).

The authors investigated the effect of T-2 toxin on rat liver mitochondrial protein synthesis. Isolated rat liver mitochondria were supplemented with an S-100 supernatant from rat liver and an external ATP-generating system. An in-vitro assay employing cycloheximide, and inhibitor of cytoplasmic protein synthesis, and chloramphenicol, and inhibitor of mitochondrial protein synthesis, to distinguish mitochondrial protein synthesis from the cytoplasmic process. Amino acid incorporation into mitochondria was dependent on the concentration of mitochondria and was inhibited by chloramphenicol. The rate of uptake of tritium leucine into mitochondrial protein was unaffected by the addition of T-2 toxin and was not a rate-limiting step in incorporation. However, 0.02 micrograms/ml of T-2 toxin decreased the rate of protein synthesis inhibition correlated with the amount of T-2 toxin taken up by the mitochondria. While T-2 toxin is known to inhibit eukaryotic protein synthesis, this is the first time T-2 was shown to inhibit mitochondrial protein synthesis.

45783 **(AD-A—192862/1/XAB) Stability of T-2, HT-2, and T-2 tetraol in biological fluids. Technical note.** Pace, J.G.; Matson, C.F. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). Feb 1988. 3p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Analytical Toxicology, Vol. 12, 48-50(Jan/Feb 1988).

The stabilities of tritium-labeled T-2, HT-2, and T-2 tetraol were studied in blood and urine at -80, 4, and 23 C for 6 months in the presence of ethylenediaminetetraacetic acid or sodium fluoride. Samples were counted with a radiochromatographic scanner and results indicated the stability of T-2 tetraol > T-2 > HT-2. Toxins were most stable when stored at -70 C, in the presence of NaF, and in urine (pH 6). They were less stable in saline (control, pH 7) and least stable in blood (pH 8). These results suggest that urine and T-2 tetraol are the biological fluid and metabolite of choice for diagnostic purposes.

45784 (CONF-8703182—Summs., pp 33-36) **Strand discrimination in mismatch repair of DNA.** Taylor, J.H.; Hare, J.T. (Florida State Univ., Tallahassee (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Some years ago the authors became interested in the possibility that cells have evolved a special system to recognize the TpG/GpmC mismatch and to preferentially remove the thymine rather than the guanine, and thereby restore the original sequence in repair. The DNA of the simian virus, SV40, was chosen as a test system. It provides a typical example of the distribution of CpGs proposed by Bird for the mouse genome. The genome has only 5243 base pairs and all but 27 of the CpG sites have been eliminated with a corresponding increase in the TpG and CpA sites. Nearly all of the remaining CpGs are clustered in the non-coding promoter region including the origin for replication. Only one HpaII site (CCGG) and two HhaI sites (GCGC) remain in the genome. Two of these are in the cluster of CpGs. A transition induced in the HpaII site that formed a mutant, 1077, with an T:A pair replacing the second C:G pair in the site was selected to make the desired mismatches because it produces a new PvuII site adjacent to the HhaI site and allows them to easily distinguish the mutant genome from the wild type (WT) by gel electrophoresis after appropriate restriction enzyme digestion.

45785 (CONF-8703182—Summs., pp 37-40) **DNA mismatch repair.** Lacks, S.A. (Brookhaven National Lab., Upton, NY (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Evidence for cellular systems capable of heteroduplex DNA mismatch repair has been found in several prokaryotic and eukaryotic species. Two bacterial systems, Hex in Streptococcus pneumoniae and Mut in Escherichia coli have been most thoroughly studied. The Hex system acts both to correct mismatches in heteroduplex DNA that is formed in DNA-mediated genetic transformation of S. pneumoniae and to avoid mutations resulting from mistakes in chromosomal DNA replication. The Mut system can correct mismatches either in artificial heteroduplex phage DNA introduced into cells of E. coli by transfection or in chromosomal DNA after errors in DNA replication.

45786 (CONF-8703182—Summs., pp 65) **In vitro transformation of human fibroblasts.** McCormick, J.J. (Michigan State Univ., East Lansing (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Since fibroblastic tumors are found in humans, their inability to malignantly transform human fibroblasts in vitro is probably an indication that the procedures used are inadequate. If, as commonly conceived, the process of carcinogenesis involves the sequential, clonal selection of cells for various premalignant phenotypes, the failure to identify one or more of these critical phenotypes could be the problem. With this in mind, they have analyzed human fibrosarcoma-derived cell lines to determine how they differ from normal fibroblasts. Unlike normal fibroblasts, 6 of 6 fibrosarcoma lines examined can grow in medium containing 0.1 mM calcium without addition of epidermal growth factor (EGF) or platelet-derived growth factor (PDGF). Normal cells require a higher calcium concentration or exposure to EGF or PDGF for growth. These data suggest that acquiring growth factor independence is a critical step when fibroblasts become tumor cells. They tested this hypothesis by the transfection of the DNA sequence of the B chain of the PDGF (sis) into normal fibroblasts.

45787 (EPRI/EA/EL—5612, pp 7.48-7.51) **Detection of 2,3,7,8-tetrachlorodibenzofuran activity in dielectric fluids by an epithelial cell culture bioassay.** Gierthy, J.F.; Lincoln, D.W. (New York State Dept. of Health, Albany (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Studies were performed to determine the feasibility of using an in vitro bioassay to detect the conversion of polychlorinated biphenyls (PCBs) to polychlorinated dibenzofurans (PCDFs) in Aroclor-based dielectric fluids subjected to pyrolysis or combustion. The bioassay is based on polyhalogenated-hydrocarbon-induced alterations in growth and cellular morphology of epithelial-cell cultures which is considered related to PCDF-induced chloracne in humans. This endpoint is very sensitive and relatively specific for the more-potent PCDFs. Pyrolysis of Aroclor 1254 at 550°C for 15 min results in a 100-fold increase in the bioassay activity, shown by gas chromatographic/mass spectrometric analysis to be correlated to enhanced PCDF levels. Results of testing of six chemically characterized, inservice transformer fluids demonstrated that the bioassay is potentially useful for economical screening of used, dielectric fluids and other substances for PCDF-like aggregate activity. 5 references, 1 table.

45788 Phosphoglycerate kinase gene from Zymomonas mobilis: cloning sequencing, and localization within the gap operon. Conway, T.; Ingram, L.O. (Univ. of Florida, Gainesville (USA)). *Journal of Bacteriology;* **170**: No. 4, 1926-1933(Apr 1988). Contract FG05-86ER13575.

The Zymomonas mobilis gene encoding phosphoglycerate kinase (EC 2.7.3.2), pgk, has been cloned into Escherichia coli and sequenced. It consists of 336 amino acids, including the N-terminal methionine, with a molecular weight of 47,384. This promoterless gene is located 225 base pairs downstream from the gap gene and is part of the gap operon. Previous studies have shown that the specific activities of glyceraldehyde-3-phosphate dehydrogenase and phosphoglycerate kinase do not change coordinately in Z. mobilis, although the two enzymes appear to be under the control of a common promoter. The translated amino acid sequence for the Z. mobilis phosphoglycerte kinase is less conserved than those of eucaryotic genes. A comparison of known sequences for phosphoglycerate kinase revealed a high degree of conservation of structure with 102 amino acid positions being retained by all. In general, the amino acid positions at the boundaries of β-sheet and α-helical regions and those connecting these regions were more highly conserved than the amino acid positions within regions of secondary structure.

45789 Purification and properties of benzoate-coenzyme a ligase, a Rhodopseudomonas palustris enzyme involved in the anaerobic degradation of benzoate. Geissler, J.F.; Harwood, C.S.; Gibson, J. (Cornell Univ., Ithaca, NY (USA)). *Journal of Bacteriology;* **170**: No. 4, 1709-1714(Apr 1988). Contract FG02-86ER13495.

A soluble benzoate-coenzyme A (CoA) ligase was purified from the phototrophic bacterium Rhodopseudomonas palustris. Synthesis of the enzyme was induced when cells were grown anaerobically in light with benzoate as the sole carbon source. Purification by chromatography successively on hydroxylapatite, phenyl-Sepharose, and hydroxylapatite yielded an electrophoretically homogeneous enzyme preparation with a specific activity of 25 μmol/min per mg of protein and a molecular weight of 60,000. The purified enzyme was insensitive to oxygen and catalyzed the Mg^{2+} ATP-dependent formation of acyl-CoA from carboxylate and free reduced CoA, with high specificity for benzoate and 2-fluorobenzoate. Apparent K/sub m/ values of 0.6 to 2 μM for benzoate, 2 to 3 μM for ATP, and 90 to 120 μM for reduced CoA were determined. The reaction product, benzoyl-CoA, was an effective inhibitor of the ligase reaction. The kinetic properties of the enzyme match the kinetics of substrate uptake by whole cells and confirm a role for benzoate-CoA ligase in maintaining entry of benzoate into cells as well as in catalyzing the first step in the anaerobic degradation of benzoate by R. palustris.

45790 Phenotypic and genotypic comparison of Escherichia coli from pristine tropical waters. Bermudez, M.; Hazen, T.C. (Univ. of Puerto Rico, Rio Piedras). *Applied and Environmental Microbiology;* **54**: No. 4, 979-980(Apr 1988). Contract AC09-76SR00001.

Nine fecal-coliform-positive strains were isolated from pristine sites in a tropical rain forest. These sites included nonpolluted rivers and water from bromeliads (epiphytes) which were 30 ft (ca. 910 cm) above the ground. Phenotypically, all of these isolates were identified as Escherichia coli. Their DNA was isolated and purified, and the base composition (G+C content) was determined and compared with that of E. coli B (ATCC 11303). The DNA from the environmental isolates was also hybridized to radiolabeled DNA from E. coli B. Eight strains had a DNA base composition similar to that of E. coli B and gave more than 75% homology with E. coli B. One strain had a different DNA base composition and a relatively low percentage of homology with the reference strain. The finding of E. coli in pristine tropical waters suggest that this bacterium could be a natural inhabitant in these environments and is not a reliable indicator or recent human fecal contamination in tropical waters. The indicators that are currently used in the tropics to test the biological quality of water should be reevaluated.

45791 Mechanisms of action of E. coli endonuclease III and T4 UV endonuclease (endonuclease V) at AP sites. Kim, J.; Linn, S. (Univ. of California, Berkeley (USA)). *Nucleic Acids Research;* **16**: No. 3, 1135-1141(11 Feb 1988). Contract FG03-86ER60395.

Treatment of DNA containing AP sites with either T4 UV endonuclease or with E. coli endonuclease III followed by a human class II AP endonuclease releases a putative β-elimination product. This result suggest that both the T4 endonuclease and E. coli endonuclease III class I AP endonucleases catalyze phosphodiester bond cleavage via a lyase- rather than a hydrolase mechanism. Indeed, we have not detected a class I AP endonuclease which hydrolytically catalyzes phosphodiester bond cleavage. Whereas these enzymes use a lyase-like rather than a hydrolytic mechanisms, they nonetheless catalyze phosphodiester bond cleavage. We suggest that the term endonuclease can be properly applied to them.

45792 CD of six different conformational rearrangements of poly[d(A-G) x d(C-T)] induced by low pH. Antao, V.P.; Gray, D.M.; Ratliff, R.L. (Univ. of Texas, Dallas (USA)). *Nucleic Acids Research;* **16**: No. 2, 719-738(25 Jan 1988).

On the basis of circular dichroism (CD) data, the authors have now identified six different conformational states (other than the duplex) of poly[d(A-G) x d(C-T)] at pH values between 8 and 2.5. Three of these structural rearrangements were observed as the pH was lowered from 8 to 2.5, and three additional rearrangements were observed as the pH was raised from 2.5 back to neutral pH. The major components of the six conformational states were defined using appropriate combinations of the CD spectra of the duplex, triplex, and denatured forms of this polymer, as well as the CD spectra of the individual single strands and their respective acid-induced self-complexes. The results show that the acid-induced rearrangements of poly[d(A-G) x d(C-T)] include not only the poly[d(C^+-T) x d(A-G) x d(C-T)] triplex, but also include the poly[d(C-T)] loop-out structure and a self-complexed form of the poly[d(A-G)] strand that is pH-dependent.

45793 Choline oxidation by intact spinach chloroplasts. Weigel, P.; Lerma, C.; Hanson, A.D. (Michigan State Univ., East Lansing (USA)). *Plant Physiology;* **86**: No. 1, 54-60(Jan 1988). Contract AC02-76ER01338.

Plants synthesize betaine by a two-step oxidation of choline (choline → betaine aldehyde → betaine). Protoplast-derived chloroplasts of spinach (Spinacia oleracea L.) carry out both reactions, more rapidly in light than in darkness. We investigated the light-stimulated oxidation of choline, using spinach chloroplasts isolated directly from leaves. The rates of choline oxidation obtained (dark and light rates: 10-50 and 100-300 nanomoles per hour per milligram chlorophyll, respectively) were approximately 20-fold higher than for protoplast-derived chloroplasts. Betaine aldehyde was the main product. Choline oxidation in darkness and light was suppressed by hypoxia. Neither uncouplers not the Calvin cycle inhibitor glyceraldehyde greatly affected choline oxidation in the light, and maximal choline oxidation was attained far below light saturation of CO_2 fixation. The light stimulation of choline oxidation was abolished by the PSII inhibitors DCMU and dibromothymoquinone, and was partially restored by adding reduced diaminodurene, an electron donor to PSI. Both methyl viologen and phenazine methosulfate prevented choline oxidation. Adding dihydroxyacetone phosphate, which can generate NADPH in organello, doubled the dark rate of choline oxidation. These results indicate that choline oxidation in chloroplasts requires oxygen, and reducing power generated from PSI. Enzymic reactions consistent with these requirements are discussed.

45794 A review of protein factors and nucleoprotein complexes involved in specific transcription by eukaryotic RNA polymerase II. Hellwig, R.J.; Niyogi, S.K. (Univ. of Tennessee-Oak Ridge Graduate School of Biomedical Sciences and Biology Div., Oak Ridge National Lab., Oak Ridge, TN 37831 (US)). pp 163-174 of DNA: Protein interactions and gene regulation. Thompson, E.B.; Papaconstantinou, J. Austin, TX; University of Texas Press (1987). Contract AC05-84OR21400.

The elucidation of the molecular mechanisms of accurate transcription initiation by eukaryotic RNA polymerase II requires knowledge of the properties of the enzyme, the structure and transcription of chromatin, the DNA sequences of transcription control signals, and the protein (and other) factors that mediate promoter recognition through their interaction with the DNA template and/or the RNA polymerase enzyme. This review focuses primarily on in vitro studies utilizing current cell-free extracts and the soluble fractions (factors?) thereof, to examine the protein-DNA interactions and nucleoprotein complexes that are involved in accurate transcription initiation on eukaryotic class II genes by RNA polymerase II.

5504 Genetics

REFER ALSO TO CITATION(S) 45788, 45840, 45875

45795 (CONF-8703182—Summs., pp 93) **Ring chromosome system to study homologous recombination, sister chromatid exchange and double strand breaks.** Game, J.C.; Sitney, K.C.; Cook, V.E.; Mortimer, R.K. (Lawrence Berkeley Lab., CA (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

The authors have been using an orthogonal-field-alteration-gel-electrophoresis (OFAGE) system to study meiotic recombination in yeast. The objective is to devise a simple system to monitor the time of appearance and amounts of a chromosomal recombinant DNA species during the course of yeast meiosis. In diploid strains with one circular and one linear copy of chromosome III, recombination between these molecules yields linear molecules of a length equal to one linear plus one circular molecule, or, for some three-strand double recombination events, one linear plus two circular molecules. OFAGE gels of DNA from meiotic cultures, when probed with chromosome III-specific DNA, do show these recombination-specific bands. The timing of recombinant molecule formation during meiosis and the abilities of various mutants to form commitment to prototroph formation occurs in interrupted meiosis experiments with strains heteroallelic at leu2 on chromosome III. Timing of prototroph commitment for chromosome III where one homolog is circular is inseparable from commitment at the his1 locus on chromosome V where both homologs are linear.

45796 (CONF-8703182—Summs., pp 96) **Studies of the molecular nature of in vivo, somatic mutation at the murine hprt locus.** Jones, I.M.; Burkhart-Schultz, K.; Strout, C. (Lawrence Livermore National Lab., CA (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW. Contract W-7405-ENG-48.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

The authors have developed a mouse model for in vivo somatic mutation using the hprt locus of cells in the lymphocyte lineage as the genetic target. Lymphocyte growth factors and thioguanine selection are used, in vitro, to clone HPRT-deficient lymphocytes for analysis of the molecular nature of mutations and to determine spontaneous, and mutagen-induced, mutant frequencies. In establishing the characteristics of this system they have studied the molecular nature of spontaneously occurring, somatic mutations of the murine hprt locus. Southern analysis, of genomic DNA of 23 mutants restricted by Eco RI, Hind III, and XMN I, has revealed 3 classes of mutations in spontaneously occurring HPRT-deficient mutant lymphocytes: deletion of all (4/23) or part (11/23) of the locus; rearrangement of the locus without detectable loss of gene sequences (3/23); and no detectable alteration (5/23). The latter class may include both single base alterations and other changes that lie below the sensitivity of the analysis. They are developing the ability to use field inversion gel electrophoresis to determine the extent of deletions of genetic material flanking hprt. The size of the hprt locus, 34kb, makes it an excellent target for analyses of major alterations of genetic material.

45797 **(PNL-SA—15469) Molecular genetics in the high-school science curriculum.** Ehrman, P.G.; Fritz, L.K. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013122/JAW.

The development of a curriculum at the high school level for genetics with experimental methods from molecular biology is described. The laboratory work includes protocols involving nucleic acids and proteins.

45798 **RNA polymerase-binding and transcription initiation sites upstream of the methyl reductase operon of Methanococcus vannielii.** Thomm, M.; Sherf, B.A.; Reeve, J.N. (Universitaet Regensburg (West Germany)). *Journal of Bacteriology;* **170**: No. 4, 1958-1961(Apr 1988). Contract FG02-87ER13731.

RNA polymerase, purified from Methanococcus vannielii, was shown by exonuclease III footprinting to bind to a 49-base pair (bp) region of DNA in the intergenic region upstream of mcrB. S1 nuclease protection experiments demonstrated that transcription initiation in vivo occurs within this region at 32 or 33 bp 5′ to the ATG translation initiation codon of mcrB and 19 or 20 bp 3′ to a TATA box.

45799 **Gene mapping with recombinant inbreds in maize.** Burr, B.; Burr, F.A.; Thompson, K.H.; Albertson, M.C.; Stuber, C.W. (Brookhaven National Lab., Upton, NY (USA)). *Genetics;* **118**: No. 3, 519-526(Mar 1988).

Recombinant inbred lines of maize have been developed for the rapid mapping of molecular probes to chromosomal location. Two recombinant inbred families have been constructed from F_2 populations of T232 x CM37 and CO159 x Tx303. A genetic map based largely on isozymes and restriction fragment length polymorphisms has been produced that covers virtually the entire maize genome. In order to map a new gene, an investigator has only to determine its allelic distribution among the recombinant inbred lines and then compare it by computer with the distributions of all previously mapped loci. The availability of the recombinant inbreds and the associated data base constitute an efficient means of mapping new molecular markers in maize.

5505 Metabolism

REFER ALSO TO CITATION(S) 45720

45800 **(NP—8770334) Studies on the biotechnological production of methyl xanthines.** Glueck, M. (Hohenheim Univ., Stuttgart (Germany, F.R.). Fakultaet 2 - Biologie). 25 Apr 1986. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770334/JAW.

Two strains of Pseudomonas putida were isolated during enrichment of caffeine-degrading microorganisms of the two, the strain Pseudomonas putida WS grew on media containing up to 2% of caffeine as the sole source of carbon and nitrogen. Of 25 further strains of bacteria and fungi, only one yeast also had caffeine-degrading characteristics. Caffeine degradation was much slower than with the two Pseudomonas strains, and caffeine was used only as a nitrogen source. This suggests two alternative methods of methyl xanthine production: 1) When graining Mutant H8 on glucose caffeine, the reaction could be interrupted with good yields after a short time. This method requires the processing of a complex mixture of caffeine, theobromine, and heteroxanthine. 2) When growing Mutant H8 on a mixture of peptone meat broth plus caffeine, the reaction can be interrupted with average yields after near-complete conversion. This method is recommended for heteroxanthine production, owing to the fact that peak heteroxanthine yields of 50% are not reached until all other methyl anthines have been converted more or less completely.

5506 Medicine

REFER ALSO TO CITATION(S) 44632, 45624, 46061

45801 (CONF-8711198—1) Radioiodinated methyl-branched fatty acids: Evaluation of catabolites formed in vivo. Knapp, F.F. Jr.; Reske, S.N.; Kirsch, G.; Ambrose, K.R.; Blystone, S.L.; Goodman, M.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012492/JAW.

From International symposium on the use of radioiodinated free fatty acids; Amsterdam, Netherlands (26 Nov 1987).

Radioiodinated terminal iodophenyl-substituted long-chain fatty acids containing either racemic mono-methyl or geminal dimethyl-branching in the alkyl chain have been shown to exhibit delayed myocardial clearance properties which make these agents useful for the SPECT evaluation of myocardial fatty acid uptake patterns. Although the myocardial clearance rate of 15-(p-iodophenyl)-3-R,S- methylpentadecanoic acid (BMIPP) is considerably delayed, in comparison with the IPPA straight-chain analogue, analysis of the radioiodinated lipids present in the outflow tract of isolated rat hearts administered BMIPP have clearly demonstrated the presence of a polar metabolite. The synthesis of β-hydroxy fatty acids has been developed to allow investigation of the possible formation of β-hydroxy catabolites in vivo. The preparation of β-hydroxy BMIPP and β-hydroxy IPPA are described, and the possible significance of their formation in vivo discussed. 4 figs.

45802 (DOE/ER/60438—3) Nuclear medicine and quantitative imaging research (quantitative studies in radiopharmaceutical science): Comprehensive progress report, April 1, 1986-December 31, 1988. Cooper, M.D.; Beck, R.N. (Chicago Univ., IL (USA). Dept. of Radiology). Jun 1988. Contract FG02-86ER60438. 79p. NTIS, PC A05. Order Number DE88014133/JAW.

This document describes several years research to improve PET imaging and diagnostic techniques in man. This program addresses the problems involving the basic science and technology underlying the physical and conceptual tools of radioactive tracer methodology as they relate to the measurement of structural and functional parameters of physiologic importance in health and disease. The principal tool is quantitative radionuclide imaging. The overall objective of this program is to further the development and transfer of radiotracer methodology from basic theory to routine clinical practice in order that individual patients and society as a whole will receive the maximum net benefit from the new knowledge gained. The focus of the research is on the development of new instruments and radiopharmaceuticals, and the evaluation of these through the phase of clinical feasibility. The reports in the study were processed separately for the data bases. (TEM)

45803 (INIS-BR—1111) Integrator for phototherapy monitoring. Netto, E.J.; Wang, B. (Centro Federal de Educacao Tecnologica do Parana (Brazil)). 1987. 2p. (CONF-8709281—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703212/JAW.

From 10. Brazilian congress on biomedical engineering; Rio de Janeiro, Brazil (14 Sep 1987).

45804 (INIS-BR—1112) Prototype radiometer for calibration of phototherapy units. Netto, E.J.; Wang, B. (Centro Federal de Educacao Tecnologica do Parana (Brazil)). 1987. 2p. (CONF-8709281—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703213/JAW.

From 10. Brazilian congress on biomedical engineering; Rio de Janeiro, Brazil (14 Sep 1987).

Published in summary form only.

45805 (INIS-mf—11738) Development of a low-cost MR-imaging system for clinical research. Final report. Post, H.; Knuettel, B. (Bruker Analytische Messtechnik G.m.b.H., Rheinstetten (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1988. 14p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754317/JAW.

Following in the footsteps of the now terminated project 01VF031, this more recent endeavour continues to explore the possibilities of applying resistive magnet designs to routine clinical use. As a consequence of the experience gained from earlier resistive magnet designs, a new generation of resistive magnets possessing a higher field strength and integrated iron shielding has been developed. This new type of magnet (field strength at 0.28 T) has replaced the initial resistive magnet (working at 0.14 T) in the Deutsche Klinik fuer Diagnostik in Wiesbaden. A more recent computer system, with greatly improved performance characteristics, has also been installed. Together with new software, this system has been tested in the Deutsche Klinik fuer Diagnostik for clinical applications.

45806 (INIS-mf—11783) Radioenzymatic determination of adrenaline and noradrenaline in plasma and its use in the diagnostic of pheochromocytomas. Neuhaus, C.P.E. (Ulm Univ. (Germany, F.R.). Fakultaet fuer Klinische Medizin). 3 Dec 1982. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754336/JAW.

The radioenzymatic determination of adrenaline and noradrenaline in human plasma for the diagnosis of pheochromocytomas was put to use after improvements were made with respect to extraction and separation steps. The plasma catecholamines at rest were distinctly higher in patients with pheochromocytomas. The plasma catecholamine level showed a significant increase as well with the glucagon test between the second and fifth minute. The method was not well suited for the localisation diagnostic where the plasma catecholamines were determined in selectively taken blood from the lower vena cava. Overall, however, the radioenzymatic determination of catecholamines in plasma proved itself to be a relatively ponderous, but exact and sensitive method for the measuring of basal catecholamine level and its changes. In the clinical area it is used as a valuable supplement to the contemporary diagnostic of pheochromocytomas. (orig./TRV).

45807 Role of arginine-292 in the substrate specificity of aspartate aminotransferase as examined by site-directed mutagenesis. Cronin, C.N.; Kirsch, J.F. (Lawrence Berkeley Lab., CA (USA)). *Biochemistry;* 27: No. 12, 4572-4579(14 Jun 1988). Contract AC03-76SF00098.

X-ray crystallographic data have implicated Arg-292 as the residue responsible for the preferred side-chain substrate specificity of asparate aminotransferase. It forms a salt bridge with the β or γ carboxylate group of the substrate. In order to test this proposal and, in addition, to attempt to reverse the substrate charge specificity of this enzyme, Arg-292 has been converted to Asp-292 by site-directed mutagenesis. The activity k/sub cat//K/sub M/) of the mutant enzyme, R292D, toward the natural anionic substrates L-aspartate, L-glutamate, and α-ketoglutarate is depressed by over 5 orders of magnitude, whereas the activity toward the keto acid pyruvate and a number of aromatic and other neutral amino acids is reduced by only 2-9-fold. These results confirm the proposal that Arg-292 is critical for the rapid turnover of substrates bearing anionic side chains and show further that, apart from the desired alteration no major perturbations of the remainder of the molecule have been made. The activity of R292D toward the cationic amino acids L-arginine, L-lysine, and L-ornithine is increased by 9-16-fold over that of wild type and the ratio (k/sub cat//K/sub M/)/sub cationic//(k/sub cat//K/sub M/)/sub anionic/ is in the range 2-40-fold for R292D, whereas this ratio has a range of [(0.3-6) x 10^{-6}]-fold for wild type. Thus, the mutation has produced an inversion of the substrate charge specificity. Possible explanations for the less-than-expected reactivity of R292D with arginine are discussed.

45808 Radioimmunotherapy with alpha-particle-emitting immunoconjugates. Macklis, R.M.; Kinsey, B.M.; Kassis, A.L.; Ferrara, J.L.M.; Atcher, R.W.; Hines, J.J.; Coleman, C.N.; Adelstein, S.J.; Burakoff, S.J. (Harvard Medical School, Boston, MA (USA)). *Science (Washington, D.C.);* 240: 1024-1026(20 May 1988). Contract FG02-86ER60460;W-31-109-ENG-38.

Alpha particles are energetic short-range ions whose higher linear energy transfer produces extreme cytotoxicity. An α-particle-emitting radioimmunoconjugate consisting of a bismuth-212-labeled

monoclonal immunoglobulin M specific for the murine T cell/neuroectodermal surface antigen Thy 1.2 was prepared. Analysis in vitro showed that the radioimmunoconjugate was selectively cytotoxic to a Thy 1.2^+ EL-4 murine tumor cell line. Approximately three bismuth-212-labeled immunoconjugates per target cell reduced the uptake of [^{3}H]thymidine by the EL-4 target cells to background levels. Mice inoculated intraperitoneally with EL-4 cells were cured of their ascites after intraperitoneal injection of 150 microcuries of the antigen-specific radioimmunoconjugate, suggesting a possible role for such conjugates in intracavitary cancer therapy. 18 references, 3 figures.

45809 **Theoretical immunology, Part 2: Proceedings.** Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Company, Inc. (1988). 405p. Addison-Wesley Publishing Company, Inc., 390 Bridge Parkway, Suite 202, Redwood City, CA 94065-1522. Contract FG04-87ER60560.

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

This document contains 43 papers on current topics in immunology. Topics include cell chemotaxis, killer cells, AIDS, antigen reactivity, t-cells, crosslinking, cell-cell adhesion, immune response, and the regulation of lymphocyte proliferation. (TEM)

5507 Microbiology

REFER ALSO TO CITATION(S) 44567, 44569, 44570, 44571, 44601, 44846, 44864

5509 Pathology

REFER ALSO TO CITATION(S) 45782, 45783, 45786, 45823, 45825, 45871, 45872

45810 **(AD-A—192646/8/XAB) Antibody to prevent the effects of brevetoxin poisoning in conscious rats. Interim report.** Templeton, C.B.; Poli, M.A.; LeClaire, R.D. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). 9 Mar 1988. 10p. NTIS, PC A02/MF A01.

The marine dinoflagellate, Ptychodiscus brevis, primarily responsible for Florida red tides, produces toxins that cause massive fish kills in the Gulf of Mexico and along the Florida coast. In humans, these toxins (brevetoxins) also cause a respiratory tract irritation from contact with seaspray and an intoxication known as neurotoxic shellfish poisoning. These toxins may be considered as potential biological warfare threat agents; therefore, finding a method of prophylaxis and therapy is imperative. The purpose of this study was to determine if an anti-brevetoxin (PbTx-2) antibody could prevent the effects seen in rats in previous brevetoxin studies, namely, reduced respiratory rates, reduced core and peripheral body temperatures, and ECG abnormalities.

45811 **(AD-A—192647/6/XAB) In vitro metabolism of t-2 mycotoxin 1,2. Interim report.** Thompson, W.L.; Pace, J.G.; O'Brien, J.C. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). 10 Nov 1986. 25p. NTIS, PC A03/MF A01.

In vitro metabolism of T-2 mycotoxin (T-2) was studied in Vero cells, rat spleen lymphocytes, chicken embryo heart cells, rat small intestinal segments, and rat liver hepatocytes. The method used was thin-layer chromatography (TLC) of (3H)T-2 and its metabolic products, followed by radioactive scanning of the plates. Vero cells, lymphocytes, and heart cells metabolized 5 to 35% of the T-2 to HT-2 mycotoxin (HT-2) after 24-hr exposure. No other metabolites were detected with these three cell systems. Rat intestinal segments, everted onto pipets, converted T-2 into three metabolites migrating in the range between T-2 tetraol and HT-2 on the TLC plates. Hepatocytes metabolized T-2 most rapidly, as indicated by complete disappearance of the parent compound within 4 hr. In addition to the T-2 peak, four predominant peaks appeared on the plates, one of them, increasing with time at the origin, was predominantly composed of glucuronide conjugates.

45812 **(AD-A—192649/2/XAB) Detection of T-2 mycotoxin metabolites in urines of exposed rats. Comparison of a potentially fieldable kit with a laboratory assay. Interim report.** Hewetson, J.F.; Wannemacher, R.W.; Hawley, R.J. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). 9 Mar 1988. 13p. NTIS, PC A03/MF A01.

Rapid methods to detect toxin exposure have been a concern of the Army since the reported use of T-2 mycotoxin as a biological warfare agent in Southeast Asia and Afghanistan. T-2 toxin was included in an exploratory development program of rapid identification systems for biological agents sponsored by the United States Army Medical Materiel Development Activity. Reported here is evidence of T-2W exposure in urines collected up to 2 weeks after rats were exposed to a sublethal dose of T-2 toxin. A laboratory radioimmunoassay (RIA) using polyclonal antibody was used to assay the urines for HT-2 or T-2 tetraol. The sensitivity of the RIA for HT-2 was 5 ng/ml and 50 ng/ml for T-2 tetraol. Some of the urines were assayed in parallel with a potentially fieldable enzyme-linked immunoassay (ELISA) developed for T-2 with a monoclonal antibody that cross reacts with HT-2.

45813 **(AD-A—192894/4/XAB) Cerebral metabolism and blood brain transport: toxicity of organophosphorus compounds. Report No. 3 (Annual) 15 April 1984-30 September 1985.** Drewes, L.R.; Singh, A.K. (Minnesota Univ., Duluth (USA). Dept. of Biochemistry). Apr 1987. 69p. NTIS, PC A04/MF A01.

The acute neurotoxicity of the organophosphorus (OP) compounds, soman and sarin was investigated using the isolated, perfused canine brain preparation. This experimental model allows a comprehensive study of the metabolic (biochemical) and physiological (vascular and electrical) responses to neurotoxicants because extra-cerebral tissues and influences are absent, and blood and tissue samples are readily collected for quantitative biochemical analyses. The specific aims of this project period were to investigate OP-induced alterations in 1)neurotransmitter (acetylcholine (ACh), amino acids, biogenic amines) metabolism; 2) cellular morphology and subcellular structures (light and electron microscopy); 3) vascular integrity (blood-brain interface damage)l and 4) regional cerebral glucose metabolism (rCMRG) and regional cerebral blood flow (rCBF). The data indicate that inhibition of acetylcholinesterase results in elevation of ACh and choline (Ch). The Ch is largely intracellular, does not originate from blood Ch, is not produced by de novo synthesis, and is probably formed from Ch-containing lipids by lipase activity which may be activated by a receptor-mediated mechanism. The enzymes involved in ACh/Ch/Ch-lipid metabolism and their regulation are putative targets for OP agents and potential sites for therapeutic intervention. It is recommended that investigations be pursued to define clearly the metabolic pathways of this key neurotransmitter.

45814 **(CONF-8703182—Summs., pp 107) O^6-methylguanine DNA methyltransferase activity in Hodgkin's disease.** Sagher, D.; Karrison, T.; Larson, R.; Schwartz, J.; Strauss, B. (Univ. of Chicago, IL (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Individuals with Hodgkins disease may be treated by a chemotherapeutic regimen which includes agents metabolized to methylating species. They have therefore initiated a study of the O^6-methylguanine DNA methyltransferase (MT) activity in Hodgkin's patients and in normal controls. As part of the study they prepare lymphoblastoid lines by EBV infection of peripheral blood lymphocytes (PBL). They ask: (1) is there any difference in MT activity of normal individuals and of those with Hodgkins disease; (2) do the PBL's of different individuals have a characteristic MT activity? The authors have found it convenient to express MT activity per cell or per μg DNA. The activity in normal individuals varies from about 3.5 to 14.7 fmol/μg DNA with a mean +/- SE of 8.2 +/- 0.64. There is a significant correlation between the activity of the lines and the PBL's ($r = 0.485$) although lines have on the average a 38% higher activity than PBL's. Activities in separate lines, independently developed from the same PBL samples have a higher

correlation (r = 0.788). The correlations imply that MT activity is a characteristic that tends to remain stable on cell transformation.

45815 (CONF-8703182—Summs., pp 112) **Role of oncogenes in progression of rat tracheal epithelial cells to neoplasia.** Thomassen, D.G.; Kelly, G. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW. Contract AC04-76EV01013.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

To determine the nature and number of specific changes required for the progression of RTE cells to neoplasia, cloned oncogenes were transfected into preneoplastic RTE cell lines and the ability of individual clones of transfected cells to form tumors in nude mice was determined. EG variant cell lines or normal RTE cells were transfected with pSV2-neo (neo) DNA alone or ligated to genomic clones of Harvey murine sarcoma virus (neo/ras) or polyome virus (neo/polyoma) and selected for resistance to the antibiotic G418 (neo/sup r/). Individual neo/sup r/ colonies were isolated, expanded and injected subcutaneously into nude mice. Transfection with neo alone did not change the tumorigenicity of normal RTE cells or either of two EG variant lines tested. Transfection with neo/polyoma did not transform normal RTE cells neoplastically but did result in the development of tumorigenic potential by both of the EG variant lines tested. Finally, transfection with neo/ras did not transform normal RTE cells neoplastically and resulted in the development of tumorigenic potential by only one of the two EG variant lines.

45816 (CONF-8703182—Summs., pp 90) **Analysis of karyotype instability in Chinese hamster cell lines during in vivo and in vitro progression.** Cooper, J.; Bartholdi, M.; Cram, S.; Kraemer, P.; Wharton, W. (Los Alamos National Lab., NM (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Karyotype instability was monitored during the spontaneous neoplastic progression of Chinese hamster cell cultures (WCHE cells) and during tumor progression of Chinese hamster cells in nude mice. Chromosome changes were detected early in cell culture and accompanied immortalization, in vitro transformation and tumorigenicity. Karyotyping was done by G-banding and by high resolution flow cytometry. Comparison of the karyotypes of the cultured cells and of the tumor derived cells indicated that karyotype instability continued in vivo and that a variety of chromosomal changes accompanied tumor formation and progression. Although two frequently recurring karyotype changes were detected, neither could be established as being necessary or sufficient for tumorigenicity. Genetic instability at the molecular level was compared to karyotypes of the WCHE cells, CHO cells that are aneuploid and homogeneous, and CHX cells that are heteroploid. Southern analysis of a midrepetitive DNA probe revealed few DNA fragment differences, despite substantial differences in karyotype.

45817 **(PB—88-204557/XAB) Terminal progress report on accelerated silicosis in sandblasters. Reprt for 1 January 1971-31 August 1974.** (Tulane Univ., New Orleans, LA (USA). School of Medicine). 1974. 12p. NTIS, PC A03/MF A01.

This report includes a summary of progress toward achievement of originally stated aims, sampling, hood protection, duration and intensity of exposure, tobacco, pulmonary function, roentgenographic results, pathology, infections, treatment, autoimmune reactions, prevention, sand substitutes, and significant results of the study.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 45809

45818 **(KFK-PEF—38) Investigations into the water flow and water conduction in spruce trees.** Strack, S.; Unger, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Feb 1988. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754351/JAW.

The water-flow systems in the xylem of healthy and ailing spruce trees, based on the distribution patterns of tritiated water (HTO), were compared. In case of the ailing tree a severely altered water-flow system was observed. Whereas in the healthy tree the injected HTO spread in the apex in a distinctly differentiated manner following the spiral pattern of the ligneous fibers, no comparable spreading pattern was detected in the ailing tree. Also the labeled water molecules distributed twice as fast in the ailing as in the healthy tree. We conclude that the water conducting cross section of the diseased tree is reduced. Indeed, heartwood formation was about 60% in the ailing as compared to 5-20% in healthy trees. The methods of determining water content in the annual rings are described. The tissue water of needles from the healthy tree showed a distinct gradation of tritium concentrations according to age. This finding suggests that there is an age specific stomatal regulation in the healthy but not in the diseased needles. Water potential measurements at various times during the vegetation period provided evidence of a tighter water budget in diseased trees; however, a chronically enhanced water stress was not evident. The role of pathological heartwood formation during the disease is discussed. (orig.) With 27 figs., 38 refs.

5520 Public Health

REFER ALSO TO CITATION(S) 44615, 44632, 44973, 45674, 45675, 45676, 45817, 45870, 45876

45819 (EPRI/EA/EL—5612, pp 5.5-5.8) **Risk analysis of PCB spill cleanup options.** Wilson, D.S.; Runke, K.D.; Cohan, D.; Kahle, K. (Decision Focus Inc., Los Altos, CA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

What residual concentration after a PCB spill cleanup is low enough to ensure public safety? How quickly should the spill be cleaned up? The fastest cleanup to the lowest levels will lead to the lowest risk, but at extraordinary, and possibly unnecessary, costs. The objective of this risk analysis was to develop a better understanding of alternative spill-cleanup options by integrating information on potential incidents, environmental fate, human exposure and deposition, and human health effects. The study analyzed potential human health risks from PCB capacitor spills for each of several spill cleanup options. The cleanup options differ in the speed of the cleanup process and the final level of residual concentration achieved in the cleanup. The cleanup options were analyzed using the EPRI Contaminated Sites Risk Management System, SITES. SITES provided a comprehensive framework for comparing cleanup options in terms of the health and environmental effects and total costs. This paper discusses the SITES methodology, and the data, assumptions, results, and conclusions of the analysis. 4 references, 4 figures, 1 table.

45820 (EPRI/EA/EL—5612, pp 5.9-5.13) **POSSM: a tool for risk assessment of PCB spills sites.** Lingle, J. (Wisconsin Electric Power Co., Milwaukee (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

POSSM, the PCB On-Site Spill Model, was developed for the Electric Power Research Institute by Brown and Boutwell in order to assist electric-utility personnel in understanding and evaluating the risks associated with spills of oil from electrical equipment. Spills of PCB or askarel-type fluids such as from PCB capacitors, as well as low-concentration PCB-contaminated mineral oil from distribution transformers can be evaluated using POSSM. The model utilizes spill information such as the volume of fluid lost, area of the spill, soil type, cleanup actions taken, soil concentrations, meteorological conditions, and other data in order to calculate the fate of the PCBs over time. POSSM was used to conduct a human-health risk assessment of two transformer oil spills and two PCB-capacitor spills that occurred over the last three years in the Wisconsin Electric system. Site-specific data were used as POSSM input in order to determine the fate of the PCBs in the soil, air, and rainfall runoff. Initial PCB loadings to the soil and vegetation were calculated based on the volume and concentration of PCBs spilled. PCB soil concentrations measured after site cleanup were used as input data to the model for the time period following cleanup. Airborne concentrations of PCBs downwind of the spill site were calculated using the PTDIS gaussian dispersion model. 3 references, 1 figure, 3 tables.

45821 (EPRI/EA/EL—5612, pp 7.11-7.14) **Ultra-sensitive bioassay for dioxin.** Schuman, R.F.; Hunter, K.W. (Westinghouse Bio-Analytic Systems Co., Rockville, MD (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) has been shown to induce ethoxyresorufin-0-deethylase (EROD) activity or other biological responses in a number of cell cultures. Using a new cell line, WBAS 86-163B, an ultra-sensitive bioassay for the detection of TCDD and related compounds was devised. The target cells can detect TCDD concentrations as low as 2×10^{-12}M, which is at least 1.5 logs more sensitive than other bioassay systems. With the WBAS cell line, an induction response can be obtained after treatment of the target cells for only 18-24 hours, four to 10 days less than required by other bioassays. These cells have been used successfully to detect TCDD in soil and water samples. Several dibenzo-p-dioxins, chlorinated phenols and polychlorinated biphenyls were tested for their abilities to induce EROD in the target cells. TCDD was at least several thousand fold more potent in eliciting a response than were the other chemicals. TCDD was 8 times more active as an EROD inducer than the next most effective chemical, 2,3,7,8-tetrachlorodibenzofuran. 11 references, 2 tables.

45822 (PB—88-197959/XAB) **Mortality study of workers at a patent fuel plant. Technical memo.** Smith, T.A.; Hurley, J.F.; Henriksen, V.J.B.; Kidd, M.W.; Ruckley, V.A. (Institute of Occupational Medicine, Edinburgh (UK)). Dec 1987. 80p. (TM—87/20). NTIS, PC E06/MF E06.

The report describes the mortality, over a 17-year period from 1 January 1967 until 31 December 1983 among workers employed at a patent fuel plant in South Wales. While employed there, men were exposed variously to pitch, coal dust, and to the fumes and by-products from coal carbonization. The main purpose of the study was to determine the association, if any, between occupation at the works and subsequent mortality. The results strongly suggest that men at the factory are exposed to work-related cancer risks, particularly of the lung and probably of bladder also, and may further be at risk of ischaemic heart disease. It seems however that excess of deaths from non-malignant respiratory illness was largely due to the employment of ex-miners with untypically poor health.

45823 (PB—88-198502/XAB) **Toxic effects of silica. Technical Memo.** Seaton, A.; Addison, J.; Davis, J.M.G.; Hurley, J.F.; McGovern, B. (Institute of Occupational Medicine, Edinburgh (UK)). Aug 1987. 94p. (TM—87/13). NTIS, PC E06/MF E06.

Quartz has been shown in experimental studies to be toxic to phagocytic cells and to initiate, when inhaled, a process of nodular lung fibrosis. Acute silicosis has been described relatively infrequently, in response to very high, uncontrolled exposures to quartz or cristobalite. It is always fatal. Classical silicosis ranges from small nodular opacities on the chest radiograph, unassociated with clinical disablement, to progressive massive fibrosis which may lead to premature death. The disease, once initiated, is usually progressive and it may occur for the first time after exposure has ceased. There is evidence from studies of human populations and of individual patients that some diseases other than silicosis may result from the inhalation of quartz.

45824 (PB—88-200878/XAB) **Objectives for the nation: occupational safety and health.** (National Inst. for Occupational Safety and Health, Rockville, MD (USA)). 1980. 13p. NTIS, PC A03/MF A01.

See also HRP-0903067.

Fifteen priority areas were identified in the 1979 Surgeon General's report pertaining to improving health in America, for which objectives were then established. Specific to the problem of occupational safety and health was modification of working conditions where individuals were exposed to toxic chemicals, harmful fibrous dusts, coal dust, cotton fiber, ionizing radiation, physical hazards, excessive noise and stress, and routinized trivial tasks. Various health problems associated with these tasks included lung cancer and other cancers, heart disease, birth defects, sensory deficits, injuries, and psychological problems. Prevention/promotion measures included potential measures aimed at worker education and development of occupational health and safety systems, service measures for preventive and treatment services, technological measures (engineering, control technology, and measurement methods), legislative and regulatory measures, and economic measures. Use of specific measures differed for different problems. Specific objectives for no later than 1990, including improving health status, reducing risk factors, improving public and professional awareness, improving services and protection, and improving surveillance and evaluation were described. Data sources at national and state or local levels were provided.

45825 (PB—88-202106/XAB) **Occupational exposures and chronic respiratory symptoms: a population-based study.** Korn, R.J.; Dockery, D.W.; Speizer, F.E.; Ware, J.H.; Ferris, B.G. (Harvard Medical School, Boston, MA (USA). Dept. of Medicine). 1987. 9p. NTIS, PC A02/MF A01.

Pub. in American Review of Respiratory Disease, Vol. 136, 298-304(1987).

Data from a random sample of 8515 white adults residing in six cities in the eastern and midwestern United States were used to examine the relationships between occupational exposures to dust or to gases and fumes and chronic respiratory symptoms. 31% of the population had a history of occupational dust exposure and 30% reported exposure to gas or to fumes. After adjusting for smoking habits, age, gender, and city of residence, subjects with either occupational exposure had significantly elevated prevalence of chronic cough, chronic phlegm, persistent wheeze, and breathlessness. The adjusted relative odds of chronic respiratory symptoms for subjects exposed to dust ranged from 1.32 to 1.60. Subjects with gas or fume exposure had relative odds of symptoms between 1.27 and 1.43 when compared to unexposed subjects. Occupational dust exposure was associated with a higher prevalence of chronic obstructive pulmonary disease (COPD) as defined by an FEV1/FVC ratio of less than 0.6, when comparing exposed and unexposed participants (OR=1.53, 95% CI=1.17-2.08). Gas or fume exposure was associated with a small, but not significant, increase in COPD prevalence. Significant trends were noted for wheeze and phlegm with increasing duration of dust exposure. Although 36% of exposed subjects reported exposure to both dust and fumes, there was no evidence of a multiplicative interaction between the effects of the individual exposures. Smoking was a significant independent predictor of symptoms, but did not appear to modify the effect of dust or fumes on symptom reporting. These data, obtained in random samples of general populations, demonstrate that chronic respiratory disease can be independently associated with occupational exposures.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 45705

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 44842, 45723

45826 **(AD-A—192634/4/XAB) Research issues for radiation protection for man during prolonged spaceflight.** Conklin, J.J.; Hagan, M.P. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 71p. (AFRRI-SR—87-35). NTIS, PC A04/MF A01.

Pub. in Advances in Radiation Biology, Vol. 13, 215-284(1987).

For the purpose of this article, radiation protection is defined as any physical, chemical, biological, or pharmacological modality that accomplishes the goal of protecting the astronaut from radiation hazard or increases his ability to assist other astronauts or spacecraft. Thoughtful examination of these largely operational considerations led to identification of medical and radiobiological research required to support the industrialization of near-Earth space. The scope of these research efforts involves thematic issues that have been defined after review of the available preliminary research from several scientific disciplines that relate to the problem of radiation protection in space. This article serves to highlight areas of research requiring further investigation. While certain of these needs for research are driven by the planned orbits involving small designated astronaut populations and well-defined durations that may be specific to the military, it is the use of geostationary orbits, permanent lunar basing, and the proposed Mars mission that form the primary basis for these operational considerations.

45827 **(AD-A—192635/1/XAB) Locomotor behavior in mice following exposure to fission-neutron irradiation and trauma.** Landauer, M.R.; Ledney, G.D.; Davis, H.D. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Dec 1987. 7p. (AFRRI-SR—87-39). NTIS, PC A02/MF A01.

Pub. in Aviation, Space, and Environmental Medicine, 1205-1210(Dec 1987).

Locomotor activity, body weights, and food and water consumption were monitored in female mice for 35 d following a sublethal wound (W), burn (B), exposure to 3 Gray fission-neutron radiation (R), or combination of these injuries: radiation-wound (RW) and radiation burn (RB). Activity in groups W and RW was depressed immediately after injury, with recovery to control levels after 5 and 14 d, respectively. Mice that received radiation alone showed a biphasic response with decrements in activity on days 0-4 and 9-11. Groups B and RB exhibited depressed activity levels that differed significantly from control levels until day 17. Food intake was reduced for about 6d in groups R, W, RW, and RB. Body weights decreased for 4 d in groups R, W, RW, and RB, but returned to control levels by the end of the experiment. Animals in group B did not show significant reduction in food intake or body weight. Water consumption was reduced for 5-6 d in groups R and RB and was increased in groups W, RW, and B. The data suggest that behavioral responses to fission-neutron radiation are exacerbated by tissue trauma.

45828 **(AD-A—192637/7/XAB) Alterations in locomotor activity induced by radioprotective doses of 16,16-dimethyl prostaglandin E2.** Landauer, M.R.; Walden, T.L.; Davis, H.D.; Dominitz, J.A. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 8p. (AFRRI-SR—87-40). NTIS, PC A02/MF A01.

Pub. in Prostaglandin and Lipid Matabolism in Radiation Injury, 245-251(1987).

16,16-Dimethyl prostaglandin E2 (DiPGE2) is an effective radioprotectant when administered before irradiation. A notable side effect of this compound is sedation. In separate experiments, the dose-response determinations of the time course of locomotor activity and 30-day survival after 10 Gy gamma irradiation (LD100) were made. Adult male CD2F1 mice were injected subcutaneously with vehicle or DiPGE2 in doses ranging from 0.01 to 40 micrograms per mouse. A dose of 0.01 micrograms did not result in alterations in locomotor behaviour or enhance survival. Doses greater than 1 microgram produced ataxia and enhanced radiation survival in a dose-dependent fashion. Full recovery of locomotor activity did not occur until 6 and 30 hr after injection for the 10 microgram and 40 microgram groups, respectively. Radioprotection was observed when DiPGE2 was administered preirradiation but not postirradiation. Doses of 1 and 10 micrograms were maximally effective as a radioprotectant if injected 5 min prior to irradiation (80%-90% survival). A dose of 40 micrograms resulted in 100% survival when injected 5-30 min before irradiation. Therefore, increasing doses of DiPGE2 resulted in an enhanced effectiveness as a radioprotectant. However, the doses that were the most radioprotective were also the most debilitating to the animal.

45829 **(AD-A—192639/3/XAB) Quantification of gut injury with diamine oxidase activity: development of a fission-neutron RBE and measurements with combined injury in mouse models.** DeBell, R.M.; Ledney, G.D.; Snyder, S.L. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 10p. (AFRRI-SR—87-36). NTIS, PC A02/MF A01.

Pub. in Radiation Research, Vol. 112, 508-516(1987).

Plasma and small-intestine diamine oxidase (DAO) activities were measured on Days 2, 4, and 6 following irradiation of mice with a range of doses of fission neutrons and cobalt 60. With increasing doses of radiation, plasma DAO activity increased on Day 2 and intestinal DAO activity decreased on Day 4; moreover, the approximate relative biological effectiveness values for these changes in activity were 5.81 for plasma DOA activity on Day 2 and 3.88 for intestinal DAO activity on Day 4. On Day 6 relatively high levels of radiation-caused DAO activity in the small intestine to remain depressed whereas low levels resulted in recovery with activities at or near controls. In animals with combined injury (radiation plus 30% surface burn or wound), changes in DAO activity in the intestine were similar to those with radiation alone; plasma DAO activity, in contrast to radiation alone, did not show an increase at the 2-day mark. These dose-dependent relationships should provide a basis for using DAO as a potential indicator of biological damage from radiation exposure within the lethal range.

45830 **(AD-A—192645/0/XAB) Effects of neutron irradiation on PGE2 and TXB2 levels in biological fluids: modification by WR2721.** Steel, L.K.; Ledney, G.D. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 13p. (AFRRI-SR—87-47). NTIS, PC A03/MF A01.

Pub. in Prostaglandin and Lipid Metabolism in Radiation Injury, 207-218(1987).

Whole-body fission-neutron irradiation of mice results in changes in plasma and urinary prostaglandin levels. No relationship was found between urinary TxB2 excretion and the neutron dose. Elevated plasma prostaglandin PGE2 at 2-4 days postexposure coincides with increased PGE2 in the urine. A second increase in urinary PGE2 occurred 6-10 days postirradiation, and was dose dependent up to 3.85 Gy. Plasma PGE2 levels at this time were normal. WR-2721 (a radioprotective phosphorothioate) administration markedly increased (24 hr) and then reduced (2-4 days) PGE2 excretion in nonirradiated animals. The urinary PGE2 of WR-2721-pretreated, irradiated mice paralleled those of drug-treated, nonirradiated animals for the first 5 days. However, WR-2721 injection did not modify the elevation of PGE2 occurring 6-10 days postexposure. Urinary TxB2 from nonirradiated groups was not altered by WR-2721, but the combination of drug and radiation resulted in increased levels 1-7 days postexposure. These results further implicate prostaglandins in the biological response to radiation exposure and suggest another mechanism of WR-2721 radioprotection.

45831 **(AD-A—192770/6/XAB) Interdependence of the radioprotective effects of human recombinant interleukin 1α, tumor-necrosis factor α, granulocyte colony-stimulating factor, and murine recombinant granulocyte-macrophage colony-stimulating factor.** Neta, R.; Oppenheim, J.J.; Douches, S.D. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1 Jan 1988. 5p. (AFRRI-SR—87-43). NTIS, PC A02/MF A01.

Pub. in Jnl. of Immunology, Vol. 140, No. 1, 108-111(1 Jan 1988).

Interleukin 1α (IL-1α), tumor-necrosis factor α (TNFα), granulocyte colony-stimulating factor (G-CSF), and granulocyte-macrophage colony-stimulating factor (GM-CSF) are molecularly distinct cytokines acting on separate receptors. The release of these cytokines can be concomitantly induced by the same signal and from the same cellular source, suggesting that they may cooperate. Administered alone, human recombinant (hr)IL-1α and hrTNFα protect lethally irradiated mice from death, whereas murine recombinant GM-CSF and hrG-CSF do not confer similar protection. On a dose basis, IL-1α is a more efficient radioprotector than TNFα. At optimal doses, IL-1α is a more-radioprotective cytokine than TNFα in C57BL/6 and B6D2F1 mice and less effective than TNFα and C3H/HeN mice, suggesting that the relative effectiveness of TNFα and IL-1α depends on the genetic makeup of the host. Administration of the two cytokines in combination results in additive radioprotection in all three strains. This suggests that the two cytokines act through different radioprotective pathways and argues against their apparent redundancy. Suboptimal, nonradioprotective doses of IL-1α also synergize with GM-CSF or G-CSF to confer optimal radioprotection, suggesting that such an interaction may be necessary for radioprotection of hemopoietic progenitor cells.

45832 **(AD-A—192772/2/XAB) Radiation-induced hematologic and nonspecific immunologic effects in the canine.** Patchen, M.L.; MacVittie, T.J.; D'Alesandro, M.M. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 5p. (AFRRI-SR—87-44). NTIS, PC A02/MF A01.

Pub. in Bioluminescence and Chemiluminescence, 62-64(1987).

A canine model was used to assess the effects of irradiation on bone-marrow progenitor cellularity, peripheral-blood leukocyte and platelet cellularity,and phagocytosis-induced granulocyte oxidation burst activity. Sexually mature beagles were bilaterally exposed to 2 Gy of cobalt-60 radiation, and at various times postirradiation bone marrow and peripheral blood samples removed. Bone-marrow granulocyte-macrophage progenitor cell (GM-CFC) numbers were reduced to approx. 10% of normal by 24 hours postexposure, and full recovery to normal GM-CFC levels was not seen until day 49 postirradiation. Peripheral-blood leukocyte and platelet values were also dramatically reduced postirradiation; by day 49 postexposure, these values had recovered to only approx. 90% of normal. The ability of percoll-isolated peripheral blood granulocytes to mount an oxidative burst in response to opsonized zymosan also decreased following irradiation. By contrast, the ability of nonisolated peripheral blood granulocytes (i.e., granulocytes in whole blood) to mount an oxidative burst in response to opsonized zymosan increased following irradiation. When sera obtained from dogs at various times postirradiation were assayed for ability to enhance the oxidative burst capacity of normal percoll-isolated peripheral blood granulocytes, stimulatory activity was detected as early as a day 2 postirradiation and persisted through day 29 postexposure. These results suggest that, although peripheral blood granulocyte numbers are decreased following radiation injury due to stem cell damage, humoral factors may enhance the function of the available granulocytes in irradiated animals.

45833 **(AD-A—192774/8/XAB) Involvement of histamine H1 and H2 receptors in hypothermia induced by ionizing radiation in guinea pigs.** Kandasamy, S.B.; Hunt, W.A. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1988. 11p. (AFRRI-SR—87-38). NTIS, PC A03/MF A01.

Pub. in Life Sciences, Vol. 42, 555-563(1988).

Radiation-induced hypothermia was examined in guinea pigs. Exposure to the head alone or whole-body irradiation-induced hypothermia, whereas exposure of the body alone produced a small insignificant response. Systemic injection of disodium cromoglycate (a mast cell stabilizer) and cimetidine (H2-receptor antagonist) had no effect on radiation-induced hypothermia, whereas systemic and central administration of mepyramine (H1-receptor antagonist) or central administration disodium cromoglycate or cimetidine attenuated it, indicating the involvement of central histamine through both H1 and H2 receptors in this response. Serotonin is not involved, since the serotonin antagonist methysergide had no effect on radiation-induced hypothermia. These results indicate that central histaminergic systems may be involved in radiation-induced hypothermia.

45834 **(AD-A—192775/5/XAB) Paradoxical role for eicosanoids: radioprotectants and radiosensitizers.** Walden Jr, T.L. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 10p. (AFRRI-SR—87-49). NTIS, PC A02/MF A01.

Pub. in Prostaglandin and Lipid Metabolism in Radiation Injury, 263-271(1987).

Understanding the radiobiology of eicosanoids is complicated by their ability to act as mediators of damage and recovery and as radioprotective agents. Changes in the tissue concentrations of eicosanoids following irradiation are dependent on several factors, including the type of eicosanoid, time postirradiation, radiation dose, and other contributing mediators and enzyme changes in the surrounding microenvironment. Many of these same prostaglandins and the leukotrienes have been shown to be radioprotective when given before irradiation.

45835 **(AD-A—192776/3/XAB) Ionizing radiation alters neuronal excitability in hippocampal slices of the guinea pig.** Tolliver, J.M.; Pellmar, T.C. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 10p. (AFRRI-SR—87-48). NTIS, PC A02/MF A01.

Pub. in Radiation Research, Vol. 112, 555-563(1987).

To investigate the effects of ionizing radiation on an isolated neuronal network without complicating systematic factors, slices of hippocampus from the guinea pig were isolated and studied in vitro. Slices were irradiated with a cobalt-60 source and compared to paired, sham-irradiated controls. Electrophysiological activity in the CA1 population of pyramidal cells was evoked by stimulation of the stratum radiatum. Analysis of the somatic and dendritic responses suggested sites of radiation damages. Orthodromatically evoked activity was significantly decreased in slices receiving greater than 75-Gy gamma radiation. The effects were dose and dose-rate dependent. At 20 Gy/min, doses of 50 Gy and greater produced synaptic impairment while doses of 75 Gy and greater also produced postsynaptic damage (i.e., the ability of the synaptic response to generate an action potential). A lower dose rate, 5 Gy/min, reduced the sensitivity of synaptic damage to radiation exposure; synaptic impairment required a dose of 100 Gy or greater at the lower dose rate. In contrast, postsynaptic damage was not sensitive to dose rate. This study demonstrates that ionizing radiation can directly affect the integrated functional activity of neurons.

45836 **(AD-A—192777/1/XAB) Peroxide alters neuronal excitability in the CA1 region of guinea-pig hippocampus in vitro.** Pellmar, T.C. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1987. 10p. (AFFRI-SR—87-45). NTIS, PC A02/MF A01.

Pub. in Neuroscience, Vol. 23, No. 2, 447-456(1987).

Effects of peroxidative damage on neuronal excitability were investigated with electrophysiological techniques in CA1 pyramidal cells of the hippocampal slice preparation. Hydrogen peroxide alone or combined with ferrous ions (peroxide/iron) is likely to produce hydroxyl free radicals through the Fenton reaction. Intracellularly recorded excitatory postsynaptic potentials and inhibitory postsynaptic potentials were significantly reduced by exposure to peroxide, while responses to iontophoretically applied gamma aminobutyric acid and glutamate were unaffected. These results suggest that peroxide has presynaptic actions. Peroxide and peroxide/iron also increased frequency adaptation; after exposure, neurons fired fewer action potentials at a lower frequency in response to the same depolarizing current step. A voltage clamp analysis revealed that the potassium currents were unaffected by peroxide/iron. Calcium current was not obviously altered by exposure to peroxide.

Sodium spike thresholds was also unaffected. Calcium spike threshold was significantly increased by peroxide. This action of peroxide may underlie its presynaptic actions. It is concluded that peroxide produces both presynaptic and postsynaptic damage. This damage is likely to result from the production of free radicals which have been postulated to underlie a number of pathological states.

45837 **(AERE-R—13007) United Kingdom Atomic Energy Authority mortality study. Supplementary tables.** Carpenter, L.; Hartnell, J.; Brown, A.; Booth, M.; Beral, V.; Fraser, P. (London School of Hygiene and Tropical Medicine (UK)). (UKAEA Harwell Lab. Environmental and Medical Science Div.). Mar 1988. 517p. H.M. Stationery Office, London, price Pound 23.00.

The results of a study on the mortality of employees of the United Kingdom Atomic Energy Authority between 1946 and 1979 has been published in the British Medical Journal (1985). This report presents 517 supplementary tables which are essentially a disaggregation of the data presented in the earlier publications. They include demographic, radiation and mortality data expressed in smaller sub-groups (e.g. by establishment) than were possible earlier. No statistical tests were made and no conclusions are drawn.

45838 (CONF-8703182—Summs., pp 111) **Development of an in vitro model for mutagenesis.** Strauss, B.; Sahm, J.; LaPointe, D.; Turkington, E. (Univ. of Chicago, IL (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

The authors are modifying the system of Kunkel (1985) to study mutations and bypass under conditions approximating those obtained in vivo. Bacteriophage M13mp2 DNA with a 789 bas lac insert, producing a peptide complementing a lac deletion in the host, is grown through two cycles in an ung$^-$ dut$^-$ host. The uracil-containing (+) strand is hybridized to a non-uracil (-) fragment with about half of the lac insert removed producing a gapped molecule. Transfection of such molecules is inefficient unless the gap is closed by synthesis and ligation. They react the (+) strand before hybridization with acetoxy acetylaminofluorene (AAAF) or other mutagens and then carry out synthesis. Transfection is ordinarily into a uvr$^-$ rec$^-$ lac$^-$ strain to minimize the chance that mutation occurs in the host organism rather than in vitro. Synthesis, even on (+) strands not containing uracil or adduct, is mutagenic and mutagenicity is increased by deoxynucleoside monophosphate. UV is slightly mutagenic. Uracil in the (+) strand is mutagenic for a uvr$^+$ rec$^+$ strain. A high proportion of plaques produced from AAAF treated (+) strands used as a template for in vitro synthesis with E. coli pol 1 (Kf) are mutant.

45839 (CONF-8703182—Summs., pp 41-44) **Radiation induced DNA damage and repair in mutagenesis.** Strniste, G.F.; Chen, D.J.; Okinaka, R.T. (Los Alamos National Lab., NM (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW. Contract W-7405-ENG-48.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

The central theme in cellular radiobiological research has been the mechanisms of radiation action and the physiological response of cells to this action. Considerable effort has been directed toward the characterization of radiation-induced DNA damage and the correlation of this damage to cellular genetic change that is expressed as mutation or initiating events leading to cellular transformation and ultimately carcinogenesis. In addition, there has been a significant advancement in their understanding of the role of DNA repair in the process of mutation leading to genetic change in cells. There is extensive literature concerning studies that address radiation action in both procaryotic and eucaryotic systems. This brief report will make no attempt to summarize this voluminous data but will focus on recent results from their laboratory of experiments in which they have examined, at both the cellular and molecular levels, the process of ionizing radiation-induced mutagenesis in cultured human cells.

45840 (CONF-8703182—Summs., pp 75-79) **Mapping genes in a chromosome region frequently deleted in mutagen-associated leukemia.** Rowley, J.D. (Univ. of Chicago, IL (USA)). 1987. NTIS, PC A07/MF A01. Order Number DE88002817/JAW. Contract FG02-86ER60408.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

Cancer cytogeneticists discovered in 1975 that a group of patients with preleukemia had a deletion of chromosome No.5 in cells obtained from the bone marrow. Some of these patients had a long but relatively stable disease characterized by refractory anemia, whereas others with apparently the same deletion had a disease that rapidly progressed to acute myeloid leukemia. One of the major unresolved questions is whether or not the genes that are affected in these two groups are the same. An attempt is made to investigate the 5q-syndrome on an analysis of bone marrow cells from patients with acute leukemia who have had cancer or lymphoma previously treated with radiation and/or chemotherapy.

45841 (IAEA-TECDOC—440, pp 303-315) **Assessment of the environmental impact of a tritium gas release. Resuspension of HTO from soil surface.** Belot, Y.; Guenot, J.; Clerc, H.; Djerassi, H.; Gulden, W. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

A fraction of the tritium gas which is released to atmosphere can be rapidly oxidized at the surface of soil, and then resuspended to atmosphere as HTO. The resuspension rate has been determined hereafter by mathematical modeling and experimental simulation. In the model, the soil-plant system is assumed to consist of N soil layers and one plant compartment. The tritiated water content of the soil and the plants is described by a system of simultaneous, first-order, linear, differential equations with discontinuous, variable coefficients. The coefficients are derived from the phenomenological equations of transfer processes at plant and soil surfaces and through the soil profile. The parameters needed as entry to the model are water vapor concentrations at soil-atmosphere interface, soil moistures and water fluxes at different depths in the soil. The resuspension rate, defined as the fraction of the deposited HTO which is resuspended per unit time, is computed from the evolution of HTO content in the totality of soil profile. In parallel to the development of the model, an experimental simulation was done to determine the resuspension rate and its evolution during a period of 10 days. This was carried out by covering a small area of undisturbed soil by a field chamber, exposing the enclosed soil to tritium gas, then flushing the chamber at a high flow rate and collecting periodically the resuspended tritiated water. Both model and experimentation show that the evolution of the resuspension rate can be represented approximatively by a single exponential function for plant-covered soil, and by a sum of exponentials for a bare soil. The model and experimental values of the initial resuspension rates were similar and comprised between 1 and 5%. This study is an introductory work to a large-scale release experiment which had been carried out very recently, and will permit to make other estimations of deposition and resuspension rates. 15 refs, 6 figs, 1 tab.

45842 **(INIS-mf—11781) Experimental studies on the radiation sensitivity of hemopoietic progenitor cells of different origins.** Braasch, E. (Ulm Univ. (Germany, F.R.). Fakultaet fuer Theoretische Medizin). 26 Nov 1982. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754334/JAW.

With the help of their colony building ability in an agar culture the radiosensitivity of granulocytically determined stems cells CFU-C of humans was ascertained from dose-response relationships with in vitro irradiation. Investigations on the radiosensitivity of CFU-C of dogs in various stages of their fetal development indicate a linked hemopoietic process in the liver and the bone marrow in

the fetus in the middle of the fetal period. The dose-response relationships of the CFU-C from humans and from dog fetus are adequately described as well by a simple exponential function.

45843 **(ORNL/TM—10851) Monte Carlo simulation of indirect damage to biomolecules irradiated in aqueous solution: The radiolysis of glycylglycine.** Bolch, W.E.; Turner, J.E.; Yoshida, H.; Jacobson, K.B.; Hamm, R.N.; Wright, H.A.; Ritchie, R.H.; Klots, C.E. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 189p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88013515/JAW.

A Monte Carlo computer code is developed for simulating the radiolysis of glycylglycine in both oxygenated and deoxygenated aqueous solution. Second, this model is used to calculate the yields of various products in solutions irradiated either by 250-kVp X-rays or by ^{60}Co gamma rays. Third, calculated product yields are compared to measured yields where available. The Monte Carlo computer codes used in this study are modified and extended versions of three existing simulation codes, written at the Oak Ridge National Laboratory (ORNL), which simulate irradiations of pure liquid water. The ORNL codes calculate the formation, diffusion, and reaction of free radicals and other species along charged-particle tracks in liquid water. As part of this research, these codes are extended to simulate irradiation of pure oxygenated water, oxygenated glycylglycine solutions, and deoxygenated glycylglycine solutions. 80 refs., 38 figs., 8 tabs.

45844 **(PNL-SA—14756) Advances in the development of Cr-39 based neutron dosimeters.** Hadlock, D.E.; Parkhurst, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1987. Contract AC06-76RL01830. 5p. (CONF-880404—15). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88008200/JAW.

From 7. international congress of the International Radiation Protection Association; Sydney, Australia (10 Apr 1988).

A combination thermoluminescent dosimeter (TLD) and track etch dosimeter (TED), which can be used for detecting neutrons over a wide energy range, has been developed through recent research in passive neutron dosimetery. This dosimeter uses Li-600 TLDs to detect thermal and low energy neutrons reflected from the body, and the TED polymer of CR-39, to detect fast neutrons from proton recoil interactions with the polyethylene radiator or with CR-39 itself. Some form of the combination dosimeter is currently in use at several US Department of Energy (DOE) facilities, and its use is expected to expand over the next year to include all DOE facilities where significant neutron exposures may occur. The extensive research conducted on the TED component over the past six years has continually focused on material improvements, reduction in processing time and dosimeter handling, and ease of sample readout with the goal of automating the process as much as possible. 1 fig.

45845 **Health effects estimation: Methods and results for properties contaminated by uranium mill tailings.** Denham, D.H.; Cross, F.T.; Soldat, J.K. (Pacific Northwest Lab., Richland, WA (US)). pp 513-525 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

This paper describes methods for estimating potential health effects from exposure to uranium mill tailings and presents a summary of risk projections for 57 mill tailings contaminated properties (residences, schools, churches, and businesses) in the United States. The methods provide realistic estimates of cancer risk to exposed individuals based on property-specific occupancy and contamination patterns. External exposure to gamma radiation, inhalation of radon daughters, and consumption of food products grown in radium-contaminated soil are considered. Most of the projected risk was from indoor exposure to radon daughters; however, for some properties the risk from consumption of locally grown food products is similar to that from radon daughters. In all cases, the projected number of lifetime cancer deaths for specific properties is less than one, but for some properties the increase in risk over that normally expected is greater than 100%.

45846 **Updating radon daughter bronchial dosimetry.** Harley, N.H.; Cohen, B.S. (Institute of Environmental Medicine, New York Univ. Medical Center, New York, NY (US)). pp 419-429 of Radon and its decay products: Occurrence, properties, and health effects. Hopke, P.K. Washington, DC; American Chemical Society (1987). (CONF-860425—).

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

The lung cancer risk from radon daughter exposure is known only for occupationally exposed males. In order to determine the risk in environmental situations it is necessary to determine whether the bronchial alpha dose, which confers the risk, is similar to that in mines. Particle size is a major factor which determines the alpha dose conversion factor for radon daughters (mGy/WLM). Data on indoor environments are emerging and indicate that a variety of specific conditions exist. For example, a dose factor four times that for a nominal occupational or environmental exposure exists if kerosene heater particles dominate the indoor aerosol and four times smaller if a hygroscopic particle dominates.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 46060

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 44668, 44783, 44880, 44886, 44942, 44943, 44944, 44945, 44946, 44947, 44948, 44949, 44950, 44951, 44952, 44953, 44954, 44956, 44957, 44970, 44981, 45428, 45446, 45711, 45750, 45787, 45819, 45838

45847 **(AD-A—192660/9/XAB) Effects of air pollution on human exercise performance.** Frykman, P.N. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). Feb 1988. 22p. NTIS, PC A03/MF A01.

The pollutants commonly experienced in cities of the United States are: carbon monoxide, ozone, peroxyacetyl nitrate, aerosols, sulfur dioxide, and nitrogen dioxide. Only carbon monoxide has been show to reduce exercise performance. The investigations which evaluated the impact of other pollutants on performance, may not have been sensitive enough to detect the small performance decrements caused. Suggested ways to avoid performance decrements are included.

45848 **(CONF-8703265—Summs.) Research into the causes of forest decline. Short versions of posters.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1987. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770224/JAW.

From Status seminar on a BMFT research project: research into the causes of forest decline; Juelich, F.R. Germany (30 Mar 1987).

In the framework of the research project 'Research into the causes of forest decline', the different subject areas were presented at the status seminar with their different reports. The subject areas are: a) model development, b) epidemiology, c) pollutant deposition and nuisance, d) symptoms of harm, inventory, wood productivity and timber quality, e) action-path above ground, stress physiology and physiology of metabolism, f) soil chemistry and nutrient balance, g) root/soil and rhizosphere. (KG)

45849 **(EPRI/EA/EL—5612, pp 1.1-1.41) Update on PCB regulations.** Allen, T.K. (Piper & Marbury, Washington, DC (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Mr. Allen reviews the activities in PCB regulations since the last PCB seminar in early 1986. The activities, he finds fall roughly into 4 areas: (1) establishment of specific-spill cleanup requirements; (2) changes to the 1985 regulations affecting use of PCB's in PCB transformers; (3) changes in regulations affecting use of PCBs in

concentrations under 50 ppm; and (4) apparent resolution of the question whether regulation of PCB disposal would be transferred from the Toxic Substances Control Act (TSCA) to the Resource Conservation and Recovery Act (RCTA). Each of these are discussed, in turn, and Mr. Allen concludes as to (4): while there once may have been an intention on EPA's part to regulate PCB disposal under RCTA, there is not now and may never be such a program.

45850 (EPRI/EA/EL—5612, pp 1.42-1.46) **EPA and state regulation of non-PCB electrical equipment: the myths and the realities.** Hardy, T.S. (Kirkland & Ellis, Washington, DC (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

Despite unique and sweeping Congressional declarations in 1976 on all polychlorinated biphenyls (PCBs), when the Environmental Protection Agency (EPA) issued in 1979 the comprehensive regulatory scheme mandated by the Toxic Substances Control Act (TSCA), its controls applied only to materials containing 50 parts-per-million (ppm) or more PCBs. Over the last eight years, concerns have arisen about the viability of the 50 ppm cutoff - leading some to question whether such low-concentration materials are truly unregulated. Review of the history of EPA's PCB regulations and their interpretation, and of state regulations that supplement the Federal rules, shows the answer is yes. 18 references.

45851 (EPRI/EA/EL—5612, pp 1.47-1.53) **Current status and options for handling and disposal of PCBs within Canada.** Beagle, R. (Power Engineering Services Ltd., Toronto, Ontario (Canada)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

This paper was generated to provide an overview of the options available to Canadians for the handling of their PCB wastes. Without going into the merits of specific technology available for each option, it is meant to show that progress is being made to formulate a long-range, permanent solution for the control of polychlorinated biphenyl waste material within Canadian borders. 4 references.

45852 (EPRI/EA/EL—5612, pp 5.14-5.18) **Employee blood screening for PCB exposure at Northwestern Rural Electric Cooperative, Inc.** Tirpak, M.D. (Northwestern Rural Electric Cooperative, Inc., Cambridge Springs, PA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

In early 1983, several employees at Northwestern Rural Electric Cooperative expressed concerns about their exposures to PCB-contaminated mineral oils and the potential future health effects that may exist. Consequently, the management at the Cooperative established, with considerable help from a local hospital, a testing protocol that could be used to satisfy employees' concerns as to the extent of body contamination. A representative sample of seven employees was selected and tested along with two hospital employees for comparison. This paper outlines the development of the testing protocol, the ensuring testing, and the associated results analysis. Only about 20 ppb were found when testing accuracy was considered. 1 reference, 1 table.

45853 (EPRI/EA/EL—5612, pp 6.31-6.36) **Comparison of estimated and actual PCB vapor exposure during a soil-excavation project.** Neely, J.; Moy, C. (Ecology and Environment, Inc., San Francisco, CA (USA)). Jan 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW. (CONF-8710221—).

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A risk assessment was conducted for a chemical-processing plant that had used the PCBs Aroclor 1248 and 1254 in its heat-exchange fluids. Concentrations of vaporized PCBs were measured at levels one to two orders of magnitude greater than had been calculated in the risk assessment. Further, the PCBs detected consisted of the lighter Aroclor 1232 or a related compound. Because dust was shown to be adequately controlled, the discrepancy between projected and actual vapor-phase PCBs could only be explained by the unforeseen formation of lighter, more volatile PCB species from partial evaporation of Aroclor 1248 and 1254, or failure to detect Aroclor 1232 in the original soil samples. Partial photolysis of the heavier PCBs could also contribute to the formation of the lower-chlorinated PCBs detected in air. 6 references, 2 figures.

45854 (IVA—310) **Environmental effects on forests of air pollution and control with new coal technology.** (Royal Swedish Academy of Engineering Sciences, Stockholm). 1986. 146p. (STYFF—13; CONF-8506392—). NTIS (US Sales Only), PC A07. Order Number DE88753694/JAW.

From Environmental effects on forests of air pollution and control with new coal technology; Stockholm, Sweden (3 Jun 1985).

This publication consists of 14 papers presented at a two staged seminar 'Environmental effects on forest of air pollution - Current status and key problems' and 'New coal technology' arranged on behalf of the Minister of Energy by Swedish German Research Association STYFF. The following titles are included: Forest damage - a status report on inventory methods. Inventory of forest damage in Sweden. Forest damage - a status report on effects on the leaves. Forest decline: a status report on the effects via soil and roots. Soil acidification and metal solubility in forest of South Sweden. Effects on soil and ground water of acid precipitation. Combustion diagnostics. NO/sub 2/ control by combustion modification in power plants. Fluidized bed technology - state of the art. Fluidized bed research and development in Sweden. Dry scrubbing. Handling if waste from coal-fired power stations. (Bok).

45855 (NP—8770220) **Occurrence and biological effects of polycyclic aromatic hydrocarbons (PAH).** (Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.)). 28 Jun 1985. 25p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770220/JAW.

The paper deals with the occurrence and genesis of PAH, their chemical analytics, biological effects, biochemical activation (carcinogenesis) and estimation of the significance of PAH for human lung cancer. (HK)

45856 (NP—8770244) **Forest decline due to nuisances. Bibliographic lists and research projects.** (Zentralstelle fuer Agrardokumentation und -Information (ZADI), Bonn (Germany, F.R.)). Nov 1983. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770244/JAW.

This publication is to be considered as a supplement to the bibliography edited in April 1983 by the 'Bundesforschungsanstalt fuer Forst- und Holzwirtschaft', Hamburg, entitled 'Acid precipitations and forest decline'. The documentation covers all the research projects relevant to the subject, as far as the editing organization obtained knowledge of them. Projects previously finalized were included, provided their termination data back no longer than eight years. All in all, the publication contains 266 research projects, with 73% taken from lists published by national agencies, 10% from the EC's technical documentation ENREP, and 17% from the CRIS research documentation of the United States. In this compilation of research projects the scope of the subject has been extended as compared to the previous bibliography. For instance, it includes such projects that deal with nuisances caused by gaseous pollutants and subsequent late damage, as well as basic research work in the form of laboratory experiments relative to the complex subject. Since forest decline constitutes a transfrontier phenomenon, great value was attributed to covering any research projects currently known in Germany and abroad. The documentation has a narrative and an index part. (orig./MG)

45857 (NP—8770245) Present state of damage-to-forests research activities. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 30 Oct 1987. 36p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770245/JAW.

The report comprises 3 parts. Part one deals with damage-to-forest research activities on the federal and regional level, DFG activities, the activities of the federal institutions and research centers. Part two summarizes the relevant present BMFT research programs. Part three informs about the damage-to-forest research activities in Switzerland, Austria, France, Sweden, the United Kingdom, the Netherlands and the United States. (MG)

45858 (NP—8770270) Effect of the heavy metals lead, cadmium, and manganese on species of green algae living in fresh water: Chlamydomonas reinhardii Dangeard and Chlorella fusca Shihira et Krauss. Comparative investigation in the accumulation, toxicity and ultracytochemical localization of heavy metals. Irmer, U. (Hamburg Univ. (Germany, F.R.). Fachbereich 14 - Biologie). 14 May 1982. 169p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770270/JAW.

The paper investigates the effect of the heavy metals lead, cadmium, and manganese on two species of green algae living in fresh water: Chlamydomonas reinhardii and Chlorella fusca. The algae were cultured by batch process and in the flow system of a turbidostat. For all investigations, pure algae material from homocontinuous respectively synchronous cultures were used. Testing was done for concentration dependence of cadmium and manganese uptake and for the toxicity of these elements and of lead. A full account of the results is given as well as a discussion of the results. (orig./KG)

45859 (NP—8770271) Outline of the findings on beryllium effects under the aspects of medicine and industrial hygiene, and investigation of lymphocyte stimulation in a group of test persons with occupational beryllium exposure using the lymphocyte transformation test. Bauer, B.A. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770271/JAW.

The suitability of the lymphocyte transformation test for measuring different beryllium levels in humans. This was found to be possible and statistically verifiable. (KG)

45860 (NP—8770281) Lead concentrations in human bone tissues. Studies on samples from 240 adults. Boehm, J. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 5 Feb 1987. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770281/JAW.

Bone tissue samples from the iliac crest, shaft of the femur, and petrous bone were taken from 240 adult corpses (from 20 years of age) on which autopsies were performed between October 1983 and February 1985. To get a uniform group with regard to sex, place of residence, and age, 10 men and 10 women per decade of life were sampled both in the area of Munich and in southern Bavaria. None of them were known to have been occupationally exposed to lead. Bone lead concentrations were determined by flameless atomic absorption spectrometry. The average total lead concentration was 41 mg in men and 74 mg in women. Bone lead concentrations in southern Bavaria were found to be significantly lower than in 1974.

45861 (NP—8770319) Cytotoxicity of airborne dusts and fly ash fractions. Enzyme release from rabbit alveolar macrophages. Gulyas, H. (Hamburg Univ. (Germany, F.R.). Fachbereich 13 - Chemie). 9 Dec 1986. 251p. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770319/JAW.

Characteristic properties of inhalable dusts, e.g. element concentrations (V, Mn, Cu, As, Cd, Co, Cr, Hg, Ni, Sb, Zn, Pb, Fe, Sn, and Ba), grain size distribution and particle numbers were to be related with the cytotoxicity of these dusts with respect to rabbit alveolar macrophages. Eight different dusts were investigated, i.e. two fly ash fractions, three airborne dusts, one airborne dust eluated with Medium 199, one eluated fly ash fraction, and standard quartz dust DQ 12. The eluates of the fly ash fraction and of the airborne dust, as well as a mixture of dissolved element compounds in a similar concentration pattern as in natural airborne dust, were used for incubating alveolar macrophages.

45862 (NP—8770327) Pb, Cd, and Mn concentrations in human tissues as a function of age, sex, lifestyle, and occupation. Tewordt, M. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 9 Jul 1986. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770327/JAW.

Nephrological and urological patients were examined in order to find out whether there is a correlation between anamnestic data and the heavy metal concentrations in various human organ tissues and whether blood and urinary concentrations yield information on the concentrations in other tissues that are accessible by biopsy, surgery, or autopsy. Further, the author intended to find out whether the known effects of age, sex, occupation, residence and organic diseases on the human organism can be validated for a randomized group of patients in the Munich region.

45863 (NP—8770330) Experimental investigations of the retention of lead and other trace elements (Fe, Cu, Zn, Mn) in juvenile and adult rats exposed to different levels of alimentary lead. Stoeckl, N.K. (Technische Univ. Muenchen, Freising (Germany, F.R.). Fakultaet fuer Landwirtschaft und Gartenbau). 5 Jun 1986. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01;1. Order Number DE88770330/JAW.

The metabolic reaction of juvenile and adult rats to different levels of alimentary lead, ranging from suboptimal to subtoxic, was determined in terms of lead retention. Dose-effect relationships were established in order to define suboptimal, optimal and subtoxic levels for assessing the lead demand. Interactions between lead and the trace elements Fe, Cu, Zn, and Mn were determined by varying the Pb supply. Three different experiments were carried out on female rats.

45864 (NP—8770343) Kinetics of cumulation and histopathological changes in the renal tissue of rats after chronic exposure to Cd in drinking water; investigation of the decay curve and reversibility of induced lesions. Mangler, B. (Hohenheim Univ., Stuttgart (Germany, F.R.)). 3 Dec 1985. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770343/JAW.

The author investigated the cumulation kinetics of the liver and kidneys, the time of occurrence of histopathological changes in the kidneys and the influence of Cd accumulations on the latter, the reversibility of these alterations after discontinuing the Cd exposure. The following parameters were investigated: General state of health; development of body weight; food and water uptake; Cd and Zn concentrations in the liver and kidneys; histological changes in the kidneys, liver, and myocardium.

45865 (NP—8770347) Phenol excretions and hemotological changes as parameters of benzene exposure. Comparative study among the adult population of two small towns. Mueller, W. (Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet). 20 Dec 1984. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770347/JAW.

The phenol excretion of the groups of adults investigated in the industrial town of Ahlen indicated a high level of benzene exposure. The mean values were twice, or even three times, as high as those of the non-exposed groups of adults analyzed in the town of Duelmen. The excretion levels clearly decreased with increasing distance of the coking plant. In the town of Duelmen, which is considered a non-exposure town, no benzene exposure was recorded for either men or women. In the town of Ahlen, the benzene emissions of the local coking plant are considered a threat to the health of the adult population. Seven months later, the coking plant had reduced its emissions. A follow-up study showed exposure levels below the hazardous level, and blood pictures had changed back to normal. (orig./MBC).

45866 (PB—88-201231/XAB) Gastrointestinal absorption of soluble uranium from drinking water. Published paper. Wrenn, M.E.; Singh, N.P.; Ruth, H.; Burleigh, D. (Utah Univ., Salt Lake City (USA). School of Medicine). Apr 1988. 8p. NTIS, PC A02/MF A01.

This manuscript describes results of an experiment to determine the gastrointestinal absorption of uranium from drinking water in 12 health adults. Most of the uranium ingested was excreted in feces in the first 2 days following ingestion of the water. The absorption was the same for (234)U and (238)U for each subject. Absorption varied among subjects from -0.02% to 2.6%, with a mean of 0.6%. Low absorption may be due to concurrent ingestion of food.

45867 (PB—88-211735/XAB) Respiratory-tract dosimetry modeling of air toxics. Overton, J.H. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). May 1988. 16p. (EPA—600/D-88/091). NTIS, PC A03/MF A01.

Development of a PBPK for the whole body in which inhalation, exhalation, and metabolism in RT tissues can be simulated is described. As an example of the model's use, the results of several experiments in which rats and humans were exposed to styrene were simulated. The predicted results agreed with the empirical data. This model results were also in agreement with the results of the model of Ramsey and Anderson (1984) which, unlike the present model, does not simulate inhalation and exhalation or explicitly model the URT and TB region. In addition to describing the development and simulation results of a PBPK model, a procedure was illustrated that used such models in combination with laboratory animal data to predict doses in humans.

45868 (PB—88-213160/XAB) Impact of a 12-month exposure to a diurnal pattern of ozone on pulmonary function, antioxidant biochemistry and immunology. Grose, E.C.; Stevens, M.A.; Hatch, G.E.; Jaskot, R.H.; Selgrade, M.J.K. (Northrop Services, Inc., Research Triangle Park, NC (USA)). May 1988. 13p. NTIS, PC A03/MF A01.

Rats were exposed for 12 months, 13 hr/day, 7 days/week to 0.06 ppm O_3; Monday through Friday, the animals received a 9-hr spike reaching a maximum concentration of 0.25 ppm. An increase in the rate of lung nitrogen washout was observed in the O_3-exposed rats. Residual volume and total lung capacity were reduced. Glutathione peroxidase and reductase activities were increased but pulmonary superoxide dismutase was unchanged. Alpha tocopherol levels were decreased in lung lavage supernatant and unchanged in lavaged cells, however, ascorbic acid and lavage fluid protein was increased. Immunological changes were not observed. Thus, chronic exposure to O_3 caused (1) functional lung changes indicative of a stiffer lung; (2) biochemical changes suggestive of increased antioxidant metabolism; and (3) no observable immunological changes.

45869 (PB—88-214754/XAB) EPA's (Environmental Protection Agency's) Integrated Air Cancer Program. Cupitt, L.; Lewtas, J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). May 1988. 12p. (EPA—600/D-88/114). NTIS, PC A03/MF A01.

See also PB—86-175437.

The Integrated Air Cancer Project (IACP) is an interdisciplinary research program designed to develop the scientific methods and data sets needed to identify the major carcinogenic chemicals in the atmosphere; to characterize the emission sources and chemical precursors that give rise to the identified chemicals; and to improve the methodology and data available for assessing human exposure and risk due to exposure to airborne carcinogens. The research effort is focused primarily on characterizing the impact of complex mixtures of products of incomplete combustion, including the gaseous, semi-volatile, and particle-bound organic species. The first phase of the project focused on the following: (1) to develop, evaluate, validate, and document the sampling and analysis methods necessary to accomplish the technical research; and (2) to attempt to extend current source apportionment techniques to account for the observed mutagenicity of the collected ambient aerosol samples.

45870 (PB—88-215165/XAB) Changes in lung function and exposure to oxidants. Final report, May 1981-May 1984. Detels, R. (California Univ., Los Angeles (USA). School of Public Health). 21 Oct 1986. 95p. NTIS, PC A05/MF A01.

This study evaluated the extent to which long-term exposure to community air was associated with long-term changes in lung function in specific symptoms of lung disease in a population survey. Changes over five years in the frequency of recorded symptoms and in lung-function tests results from three study areas in Los Angeles County were compared in order to indicate the effects of aging and environment. Observed changes in both lung measures were less among persons who had never smoked than among smokers. There were no differences detected between communities in the increase or decrease of reported symptoms. The majority of the decreases in pulmonary function in adults in the low-pollution area (Lancaster) were less than in the other areas.

45871 (PB—88-215660/XAB) Nitrogen dioxide effects on progression of mouse lymphoma, a blood cell malignancy. Final report, 17 July 1986-16 April 1988. Richters, A. (University of Southern California, Los Angeles (USA). Dept. of Pathology). 8 Mar 1988. 39p. NTIS, PC A03/MF A01.

See also DE83-014964.

Earlier studies employing the injection of cancer cells into mice indicated that nitrogen dioxide facilitated the spread and establishment of cancer. The study was initiated to verify that finding, using an animal model that has more similarities to human cancer. The model used was a strain of mouse (AKR/cum) that develops a spontaneous blood-cell malignancy. The results of the study showed that the malignancy tended to develop later and spread less extensively while the percentage of specific T-lymphocytes was reduced in mice exposed to 0.25-ppm nitrogen dioxide when compared to mice held in clean air. Mortality due to cancer in the exposed mice was also reduced. The investigators noted that the result is consistent with exposure causing impairment of immune cells, the T-lymphocytes that participate in the malignancy. These results suggest that, at least in the strain of mouse studied, ambient levels of nitrogen dioxide may affect the immune system.

45872 (PB—88-866330/XAB) Toxicity of halogenated organic compounds. March 1983-June 1988 (citations from the NTIS data base). Report for March 1983-June 1988. (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 253p. NTIS PC N01/MF N01.

Supersedes PB—87-863247.

This bibliography contains citations concerning health and environmental effects of halogenated organic compounds. Topics include laboratory and field investigations regarding bioaccumulation and concentration, metabolic aspects, and specific site studies in industrial and commercial operations. Pesticides, solvents, and a variety of industrial compounds are discussed. (This updated bibliography contains 398 citations, 78 of which are new entries to the previous edition.)

45873 Trichloroethylene biodegradation by a methane-oxidizing bacterium. Little, C.D.; Palumbo, A.V.; Herbes, S.E.; Lidstrom, M.E.; Tyndall, R.L.; Gilmer, P.J. (Oak Ridge National Lab., TN (USA)). *Applied and Environmental Microbiology;* **54**: No. 4, 951-956(Apr 1988). Contract AC05-84OR21400;FG03-85ER13306.

Trichloroethylene (TCE), a common ground water contaminant, is a suspected carcinogen that is highly resistant to aerobic biodegradation. An aerobic, methane-oxidizing bacterium was isolated that degrades TCE in pure culture at concentrations commonly observed in contaminated ground water. Strain 46-1, a type I methanotrophic bacterium, degraded TCE if grown on methane or methanol, producing CO_2 and water-soluble products. Gas chromatography and ^{14}C radiotracer techniques were used to determine the rate, methane dependence, and mechanism of TCE biodegradation. TCE biodegradation by strain 46-1 appears to be a cometabolic process that occurs when the organism is actively metabolizing a suitable growth substrate such as methane or methanol. It is proposed that TCE biodegradation by methanotrophs occurs by formation of TCE epoxide, which breaks down spontaneously in water to form dichloroacetic and glyoxylic acids and one-carbon products.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 45325

45874 (AD-A—192304/4/XAB) Long-term bioeffects of 435-MHz radiofrequency radiation on selected blood-borne endpoints in cannulated rats. Volume 6. Cardiovascular studies. Final report, October 1982-June 1985. Popovic, V.P.; Toler, J.C.; Bonasera, S.J.; Popovic, P.P.; Honeycutt, C.B. (Georgia Inst. of Tech., Atlanta (USA). Research Inst.). Jan 1988. 70p. NTIS, PC A04/MF A01.

Two hundred adult male white rats with chronically implanted aortic cannulas were randomly divided into 2 groups. Animals in the first group were exposed to low-level pulsed-wave 435-MHz radiofrequency radiation for approximately 22 hours daily, 7 days a week, for 6 months. Animals in the second group were maintained under identical conditions but were not radiated. The cannulas were used to record heart rate and arterial blood pressure in unrestrained, unanesthetized rats. Statistical analysis of the results did not indicate any increase in heart rate or arterial blood pressure of RFR-exposed animals when compared to sham-exposed animals. Thus, chronic exposure to the low-level radiofrequency environment did not induce stress that was manifested as increases in heart rate or mean arterial blood pressure. This result correlated with the conclusion of a previous report demonstrating no RFR effects on plasma norepinephrine and epinephrine concentrations in the group of rats.

45875 (AD-A—192687/2/XAB) Genetic effects of low level microwave radiation. Annual report, March 1987-March 1988. Saffer, J.D. (Jackson Lab., Bar Harbor, ME (USA)). 1 Mar 1988. 5p. NTIS, PC A02/MF A01.

A biological model system was developed for examining the effects of electromagnetic radiation at the cellular level. This system features 1) a simple bacterial model with plasmid DNA that can be manipulated at the molecular level, 2) an assay that includes biological amplification for detecting subtle alterations, and 3) low variability usually inherent in biological assays. This system was used to study the effects of nondestructive free electron laser (FEL) radiation on biological processes in whole cells. The the model system was tested using microwave radiation and subtle changes in the plasmid-encoded Beta-galactosidase activity can be detected. The effect observed is not duplicated by bulk heating of the bacterial culture and there is no effect on purified Beta-galactosidase.

45876 (PB—88-204607/XAB) Hazard-evaluation and technical-assistance report HETA 88-095-0000, Environmental Protection Agency, Cincinnati, Ohio. Tubbs, R.L.; Franks, J.; Lempert, B.; Flesch, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Feb 1988. 21p. NTIS, PC A03/MF A01.

See also PB—86-206059.

In response to a request concerning excessive noise exposures and subsequent hearing losses, noise exposures were evaluated at the Andrew Breidenbach Environmental Protection Agency Laboratory (SIC-9511), Cincinnati, Ohio. Particular attention was paid to workers exposed to very-high-frequency noises being emitted by the turbomolecular pumps of the gas chromatographs. A walk through survey and octave band noise analyses were conducted in ten different laboratories. Sound level readings were obtained from the following types of equipment: gas chromatographs and supporting equipment; plasma atomcomp and supporting equipment; turbomolecular pumps; a glass ampoule sorting, filling, and sealing machine; a Millipore water filtration system; ventilation systems; vapor-containment hoods; and a modified cement mixer. The authors conclude that no health hazard exists at this facility due to noise exposure. Recommendations were made to continue additional soundproofing steps and to encourage wearing of hearing protective devices in noisy areas of the laboratory.

57 Health And Safety

REFER ALSO TO CITATION(S) 45452, 45650, 45855

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 44610, 44749, 45733, 45734

45877 (CBPF-NF—028/83) Recent advances in quaternary geochronology. Poupeau, G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703102/JAW.

Significant progress has occurred in quaternary geochronology. These include both (i) improvements in Fission Track and Thermoluminescence dating, as well as (ii) new technologies for short-lived (i.e. with half lives <or approx., 10/sup 6/ yrs) radionuclide measurements as with the /sup 14/C or uranium series desequilibrium dating, and finally (iii) the emergence of entirely new dating approches as the Electron Spin Resonnance Method. The aim of this paper is to review these progresses and the new areas they open geochronology for the past-miocene times.

45878 (CRIE-U—87040) Mechanism of chemical weathering of mudstone. Oxidation experiment by use of apparatus for rock weathering. Chigira, Masahiro; Sone, Kenji. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 27p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753864/JAW.

Weathering experiment of mudstone, a sedimentary rock, by oxidation of contained pyrite was carried out. Rock specimens were stressed uniaxially under the stress of 5 kgf/cm^2 in 15°C water of which pH was 7 and DO (dissolved oxygen) was 13.5 or 4 mg/l for weathering time of 52 days. A large amount of pyrite was contained in the specimens which was oxidized by dissolved oxygen and dissolved with the passage of time. The elastic wave velocity and uniaxial strength of the specimens decreased and the porosity increased with time when DO was high (13.5 mg/l), but not when DO was low (4 mg/l) although the porosity increased slightly. The decrease of pyrite grains and dissolution of other minerals by acid seem to be the main causes of the change of physical properties of the specimens weathered. (19 figs, 8 tabs, 24 refs)

45879 (CRIE-U—87041) Mechanism of chemical weathering of mudstone. Weathering under the natural condition and slope stability. Chigira, Masahiro. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 25p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753865/JAW.

The mechanism of the chemical weathering, changes in chemical, mineralogical, and physical properties of mudstone is disclosed for the first time by this report. 32 specimens were collected from drilled cores, and mineralogical analysis, chemical analysis as well as the measurement of pH, density, and porosity were carried out. The chemical analysis revealed that there are the dissolution front and oxidation front. At the dissolution front, many chemical components are leached out to a large extent, decreasing the density and increasing the porosity. At the oxidation front, S and C are lost almost completely and FeO changed into Fe_2O_3. Pyrite and chlorite are lost and smectite (montmorillonite) increases. The two fronts are a pair, and the dissolution front is a front reached by acid generated by the pyrite oxidation at the oxidation front. (18 figs, 8 tabs, 20 refs)

45880 (INIS-BR—1130) Isotopic hydrology in the Tucano sedimentary Basin, Bahia in Brazil. Azevedo, A.E.G. de. (Bahia Univ., Salvador (Brazil)). 1984. 1p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703550/JAW.

45881 **(ORNL/TM—10749) Subsurface geology of the Chickamauga Group at Oak Ridge National Laboratory.** Lee, R.R.; Ketelle, R.H. (Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013509/JAW.

Analysis of rock core and geophysical log data acquired from five core holes in the Oak Ridge National Laboratory (ORNL) Main Plant Area indicates the Middle Ordovician Chickamauga Group is a lithologically diverse rock unit. Subdivision of the Chickamauga into nongenetic rock units (Units A-H) is consistent with the position of major lithologic breaks identified in both ore and geophysical logs; the placement of these units is in close agreement with their placement in previous work at ORNL. Lithologic variability and interfingering occurs commonly within units, and comparison of correlative intervals from adjacent core holes suggests that lateral variability also occurs commonly. Small-to intermediate-scale structural features, typical of rocks elsewhere on the Oak Ridge Reservation, are absent in the Chickamauga at ORNL. Although numerous high-angle fractures are identified, characteristic structural features in the Chickamauga at ORNL are ubiquitous bedding plane fractures and polished bedding plane partings with slickensides. This style of internal structural deformation is attributed to the mechanical behavior of the strongly interbedded Chickamauga lithologies during Appalachian Orogeny deformation. 12 refs., 5 figs., 2 tabs.

45882 **Pine Mountain terrane, a complex window in the Georgia and Alabama Piedmont: evidence from the eastern termination.** Hooper, R.J.; Hatcher, R.D. Jr. (Univ. of South Florida, Tampa (USA)). *Geology;* **16**: No. 4, 307-310(Apr 1988). Contract AC05-84OR21400.

The Pine Mountain terrane is exposed in a complex window within the Piedmont of Georgia and Alabama. The eastern end of the terrane is framed by three ductile faults of demonstrably different ages. The polydeformed pre-thermal peak Box Ankle fault is truncated to the south by the younger pre-thermal peak Goat Rock fault, and to the north by the even younger post-thermal peak Towaliga fault. The three faults framing the eastern termination of the window are clearly neither (1) part of the same detachment nor (2) part of the Appalachian detachment.

45883 **Depositional facies of the Miocene-Pliocene Ogallala Formation, northwestern Texas and eastern New Mexico.** Gustavson, T.C.; Winkler, D.A. (Univ. of Texas, Austin (USA)). *Geology;* **16**: No. 3, 203-206(Mar 1988). Contract AC97-83WM46651.

Deposition of the basal fluvial sediments of the Miocene-Pliocene Ogallala Formation in western Texas and eastern New Mexico was controlled by topography on the underlying erosional surface. Paleovalley-fill facies consist of gravelly and sandy braided-stream deposits interbedded with and overlain by eolian sediments deposited as sand sheets and loess. Uplands on the pre-Ogallala erosional surface are overlain primarily by similar eolian sediments. Calcic paleosols, consisting mostly of glaebules and rhizoconcretions of $CaCO_3$, occur throughout the eolian facies. Massive to laminated and locally pisolitic, brecciated, and recemented pedogenic calcretes occur primarily near or at the top of the Ogallala Formation. Eolian facies preserve numerous superposed calcretes and calcic paleosols, reflecting slow episodic aggradation on a savannah or grassland under arid to subhumid climatic conditions. The change from fluvial to mostly eolian sedimentation probably resulted from diversion of streams that deposited fluvial sediments of the Ogallala Formation to form the Pecos and Canadian rivers. Source areas for eolian sediments may initially have been flood plains of Ogallala braided streams and later the flood plains of the newly formed Pecos and Canadian rivers. 38 references.

5802 Geophysics

REFER ALSO TO CITATION(S) 44656, 45056, 45057, 45058, 45696, 45706

45884 **(CEA-DAS—456) Recent developments in matter of strong motions data bank creation held by ENEA (Rome), Imperial College (London) and CEA/IPSN (Paris).** Goula, X.; Mohammadioun, G.; Rinaldi, D.; Bommer, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete; ENEA, Rome (IT); Imperial Coll. of Science and Technology, London (GB)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 6p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754202/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

A pooling of strong motion data held by ENEA (Rome), Imperial College (London) and CEA/IPSN (Paris) will, in the future, give rise to a unified set of data, accessible from any one of the three centers, composed of a data bank of uncorrected accelerograms associated with an accessory data base containing as ample information as possible concerning the earthquake itself and the recording conditions. All three centers are equipped with VAX computer material, and a DECNET link is currently under consideration. The data thus structured is destined to form the basis of a European strong-motion data bank.

45885 **(CEA-DAS—457e) Investigation of strong motion processing procedures.** Rinaldi, D.; Goula, X.; Menu, J.M. (ENEA, Rome (IT); Imperial Coll. of Science and Technology, London (GB)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 10p. (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754203/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

The work which is described here presents preliminary results of an on-going research relating to the accurate recording and quality processing of earthquake strong ground motions. The work is the product of a tripartite co-operation between three European Centres (ENEA, PAS-ISP Laboratorio Ingengneria dei Siti, Rome/CEA, IPSN, Fontenay-aux-Roses, ICST, Department of Civil Engineering, London), which have carried out independently similar research in the recent past. Other European Institutes joined the three mentioned organizations for discussions during a Workshop (June 1985) held in Casaccia (ENEA Research Centre of Rome). The aim of the research is a thorough analysis of various factors affecting the recovery of true ground accelerations recorded with analogue instruments. The separate and cumulative effects of the type of recording accelerometer, the digitization equipment and the correction routines have been analysed. Global comparisons have been achieved to obtain a general insight into various standard processing procedures.

45886 **(CEA-DAS—458) Contribution for seismotectonic zoning of France.** Combes, P.; Goula, X. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Mar 1988. 10p. (In French). (CONF-8803130—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754204/JAW.

From AFPS meeting on seismic hazards for the engineer; Saint-Remy-les-Chevreuxe, France (16 Mar 1988).

The general procedure to arrive at the tectonic zoning of France is presented herewith. The appropriate subjects selected allow the present structure of the continental crust, as well as the major tectonic events which led to its structuration, to be described. The analysis of these tectonic structures can define the homogeneous zones with different characteristics. Seismic activity of the different zones is approached by computation of the frequency of earthquake occurrence in terms of macroseismic intensity or magnitude. Some preliminary maps of occurrence frequency are proposed.

45887 (NP—8770280) Time dependence of mantle convection and of double layer convection in magma chambers. Hansen, U. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Feb 1987. 162p. (In German). NTIS (US Sales Only), PC A08. Order Number DE88770280/JAW.

Thermal mantle convection and double layer diffusive convection in magma chambers were investigated in numerical experiments using a finite element method. In both cases, an ideal model consisting of a Boussinesq fluid at a finite Prandtl number in a two-dimensional region was assumed. A status report on research is followed by a report on thermal convection in the strongly nonlinear region (nonlinear dynamics, boundary layers) and a description of a mathematical model (basic equation, numerical solutions). Findings on heat transfer and lateral inhomogeneities leading to boundary layer instabilities are presented, together with findings on the interactions between small-scale instabilities and large-area flow and on the effects of lateral inhomogeneities on the development with time of flow conditions. Double diffusive convection is gone into (fundamentals, magma chambers, comparative calculations, subcritical double diffusive convection). (HWJ).

45888 (NUREG/CR—5165) Seismological investigation of earthquakes in the New Madrid seismic zone and the northeastern extent of the New Madrid seismic zone: Final report, September 1981-December 1986. Herrmann, R.B.; Taylor, K.; Nguyen, B. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Jul 1988. 43p. NTIS, PC A04/MF A01 - GPO. Order Number TI88013879/JAW.

Earthquake activity in the Central Mississippi Valley has been monitored by an eight station seismograph network in the Wabash River Valley of southeastern Illinois and by a six station seismograph network in the New Madrid seismic zone. This network is a major component of a larger network in the region, jointly sponsored by the NRC, USGS, universities and states. During the time period of the contract, October 1981 through December 1986, 1206 earthquakes were located in the Central Mississippi Valley, of which 808 were in the New Madrid, Missouri area. Significant earthquakes studied in detail occurred in northeastern Ohio on January 31, 1986 and in southeastern Illinois on June 10, 1987. Focal mechanisms have been calculated for the 10 June 1987 southern Illinois earthquake using both P-wave first motions and long-period surface-wave spectral amplitude data. The long-period surface-wave and strong ground motion accelerogram recordings of the January 3, 1986, northeastern Ohio earthquake were used to estimate the focal mechanism and source time function of the source.←

45889 Displacements and tilts from dip-slip faults and magma chambers beneath irregular surface topography. McTigue, D.F.; Segall, P. (Sandia National Laboratories, Albuquerque, NM). *Geophysical Research Letters;* **15**: No. 6, 601-604(Jun 1988).

Surface displacements and tilts due to buried deformation sources are influenced by topography. The leading-order corrections due to topography of arbitrary profile, but small slope, are determined for dip-slip faults (edge dislocations) and magma bodies (lines of inflation) in a two-dimensional elastic medium. The vertical displacement correction is simply the product of the topography and the horizontal normal strain due to the source in a flat half-space. The correction for a normal fault beneath an idealized basin-and-range topography is a slight increase in the uplift on the range side. The effect of topography for a line of inflation beneath a symmetric volcano is to reduce the central uplift. Failure to account for topographic influences can bias estimates of source depth and geometry. copyright American Geophysical Union 1988

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 44653, 44656, 45278, 45279, 45280, 45820, 45895, 45896

45890 (NEI-NO—45) Geology and soil condition on the Norwegian continental shelfsurvey. Gunleiksrud, T. (Instituut for Kontinentalsokkelundersoekelser, Trondheim (Norway)). 1986. 34p. (In Norwegian). (CONF-8601143—1). NTIS (US Sales Only), PC A03. Order Number DE88753702/JAW.

From Offshore platforms - correlation between soil and structure; Trondheim, Norway (6 Jan 1986).

The report is a conference paper on the interaction between offshore installations and the sea-bed soil for Haltenbanken and Tromsoeflaket on the Norwegian continental shelf. Data are presented on the penetration conditions for clay, soil properties for various depth intervals, and geotechnical parameters. 24 drawings, 3 tables.

45891 Pegmatite-wallrock interaction: holmquistite-bearing amphibolite, Edison pegmatite, Black Hills, South Dakota. Shearer, C.K.; Papike, J.J. (South Dakota School of Mines and Technology, Rapid City (USA)). *American Mineralogist;* **73**: No. 3-4, 324-337(Mar-Apr 1988). Contract FG01-84ER13259.

The fluid transport of relatively incompatible elements (Li, Rb, Cs) out of the rare-element pegmatite system and the subsequent interaction between that fluid and amphibolite result in the stabilization of holmquistite-bearing assemblages. In the amphibolite adjacent to the Edison pegmatite, Black Hills, South Dakota, three amphibolite assemblages resulting from fluid-country rock interaction can be distinguished: (1) biotite alteration assemblage, (2) hornblende-holmquistite alteration assemblage, and (3) hornblende-plagioclase assemblage. Holmquistite occurs only in assemblages 1 and 2 in which it coexists with and partially replaces hornblende. In coexisting holmquistite-hornblende pairs, the ($Al + Fe^{3+} + 2Ti^{4+}$) value is greater, and the ($Fe^{2+} + Mn$)/($Fe^{2+} + Mn + Mg$) ratio is less in holmquistite than in coexisting hornblende. By analogy to calcic and Fe-Mg amphiboles, a wide compositional gap exists between calcic and Li-rich amphiboles at temperatures of alteration-zone formation. The alteration of the amphibolite appears to be the result of (1) Li and K metasomatic alteration by alkali-rich, pegmatite-derived aqueous fluids and (2) retrograde metamorphism by the aqueous fluids resulting in the instability of plagioclase and ilmenite and the formation of epidote and sphene. The fluid has low B and F concentrations relative to fluids derived from lepidolite-bearing pegmatites in the same region. The conditions at which the alteration occurred were between 510 and 350°C at 3-4 kbar. Field and textural evidence cannot discriminate between a single fluid-amphibolite interaction model and a multiple fluid-amphibolite interaction model. 51 references.

5804 Geochemistry

45892 Aqueous pyrite oxidation by dissolved oxygen and by ferric iron. Moses, C.O.; Nordstrom, D.K.; Herman, J.S.; Mills, A.L. (Univ. of Virginia, Charlottesville (USA)). *Geochimica et Cosmochimica Acta;* **51**: No. 6, 1561-1571(Jun 1987). Contract FG05-79EV10209.

Rates of aqueous, abiotic pyrite oxidation were measured in oxygen-saturated and anaerobic Fe(III)-saturated solutions with initial pH from 2 to 9. These studies included analyses of sulfite, thiosulfate, polythionates, and sulfate, and procedures for cleaning oxidation products from pyrite surfaces were evaluated. Pyrite oxidation in oxygen-saturated solutions produced (1) rates that were only slightly dependent on initial pH, (2) linear increases in sulfoxy anions, and (3) thiosulfate and polythionates at pH $>$ 3.9 Intermediate sulfoxy anions were observed only at high stirring rates. In anaerobic Fe(III)-saturated solutions, no intermediates were observed except traces of sulfite at pH 9. The faster rate of oxidation in Fe(III)-saturated solutions supports a reaction mechanism in which Fe(III) is the direct oxidant of pyrite in both aerobic and anaerobic systems. The proposal of this mechanism is also supported

by theoretical considerations regarding the low probability of a direct reaction between paramagnetic molecular oxygen and diamagnetic pyrite. Results from a study of sphalerite oxidation support the hypothesis that thiosulfate is a key intermediate in sulfate production, regardless of the bonding structure of the sulfide mineral.

45803 **Chemical equilibrium algorithm for highly nonideal multiphase systems: free energy minimization.** Harvie, C.E.; Greenberg, J.P.; Weare, J.H. (Univ. of California, San Diego, La Jolla (USA)). *Geochimica et Cosmochimica Acta;* **51**: No. 5, 1045-1057(May 1987). Contract AC03-85SF15522.

A method is presented for calculating equilibrium phase assemblages in very nonideal systems. It may be applied to any system for which a thermodynamically consistent model of the free energy which satisfies the usual Maxwell relations and convexity criterion is available. The algorithm minimizes the Gibbs free energy by independently choosing stable reaction directions. The procedure is described in detail and various numerical problems encountered and strategies for dealing with them are discussed. It will be shown that the necessary and sufficient conditions for solution phase selection may be derived from the values of the Lagrange multipliers corresponding to constraints on phases that are not present in the system. The method for evaluating the solution phase Lagrangian multipliers and choosing the optimum composition with which to bring the new solution phase into the system involves a separate constrained minimization problem. This method is sufficiently general so that the correct phase assemblage is chosen free from external control. Special procedures for adding and removing phases including solution phases are also described.

45804 **Modeling solute transport and sulfate reduction in marsh sediments.** Casey, W.H.; Lasage, A.C. (Pennsylvania State Univ., University Park (USA)). *Geochimica et Cosmochimica Acta;* **51**: No. 5, 1109-1120(May 1987). Contract AC04-76DP00789.

The seasonal oscillation in sulfate and chloride concentration profiles in some salt marsh sediments is due to exchange of solutes with water on the surface of the marsh, and to the desiccation of the sediment in summer. Desiccation is manifested by disappearance of surface waters, fluctuations in the location of the water table, and by removal of water from the sediment above the water table. The loss of water from the pore space is commonly accompanied by entry of air into the soil, which oxidizes sulfide. The oxidation causes titratable alkalinity to decrease and results in CO_2 degassing. Diffusion models of salinity can account for the observed profiles but only as long as the marsh in maintained inundated. The complexities introduced to the solute transport equations by sediment desiccation invalidate steady-state modeling of solute transport and diagenesis. The concentration profiles of dissolved products of sulfate reduction, such as bicarbonate, require months to reestablish a steady state after being disrupted. If the profiles of dissolved products of sulfate reduction are disrupted seasonally,such as by a season fluctuation in the water table, they may remain transient throughout the year.

45805 **Application of empirical ionic models to SiO_2 liquid: potential model approximations and integration of SiO_2 polymorph data.** Erikson, R.L.; Hostetler, C.J. (Pacific Northwest Labs., Richland, WA (USA)). *Geochimica et Cosmochimica Acta;* **51**: No. 5, 1209-1218(May 1987). Contract AC06-76RL01830.

Structural and thermodynamic properties of crystalline SiO_2 and SiO_2 liquid have been examined with Monte Carlo (MC), molecular dynamics (MD), and energy minimization (EM) calculations using several ionic potential models obtained from the literature. The MC and MD methods calculate the same structural and thermodynamic properties for liquids when the same potential model is used. The EWALD (1921) method of calculating coulomb interactions reproduced most successfully the structure of liquid silica. The system internal energies show that liquid structures derived from random starting configurations can be metastable relative to structures calculated from crystalline starting configurations. The static lattice properties of the polymorphs alpha-quartz, coesite, and stishovite were used to evaluate further the accuracy of different sets of repulsive parameters for the full Ewald ionic model. Most of the models studied reproduced poorly the measured structures and elastic constants of the polymorphs. By using additional information to constrain the parameterization of the ionic model, such as estimated bond strengths and static properties of the silica polymorphs, a model more representative of the interparticle interactions may be obtained.

45806 **Association of major, minor and trace inorganic elements with lignites. II. Minerals, and major and minor element profiles, in four seams.** Miller, R.N.; Given, P.H. (Pennsylvania State Univ., University Park (USA)). *Geochimica et Cosmochimica Acta;* **51**: No. 5, 1311-1322(May 1987).

Inorganic elements in lignites may be present in carboxylate salts and organic coordination complexes as well as in discrete mineral phases. Moreover, organic matter can alter mineral phases in peats. The objectives of this study are to investigate how a number of important elements are held in some typical lignites and hence to document organic/inorganic interactions of various kinds. Accordingly, detailed profiles of the distribution of 10 major and minor elements through four lignite seams have been made, including roof and floor rocks and any mineral partings. Elements extractable by 1.0 N ammonium acetate and by 1.0 N HCl and in the insoluble residue have been analyzed by plasma arc emission and atomic absorption spectrometry. Mineral phases were analyzed by x-ray diffraction and infrared spectrometry. Substantial proportions of the Ca, Mg, Sr, Ba, Na and Mn were extractable from the organic zones, but not the inorganic, by ammonium acetate, and were inferred to have been present in the organic matter as carboxylate salts. Part of the Mn was in the organic matter either complexed or dispersed as acid-soluble mineral. Acid-soluble Al and Ti were found to be quite abundant in the organic layers but not in the roof and floor; they probably are complexed with the organic matter. The principal conclusion is that the organic matter in peat and lignites has a profound influence, in many ways, on the suite of inorganic materials with which it becomes associated.

5805 Oceanography

45807 **Summer-winter comparison of Weddell Sea surface water and its productivity.** Chen, C.T.A. (National Sun Yat-Sen Univ., Kaohsiung (Taiwan)). *Antarctic Journal of the United States;* **21**: No. 5, 128-129(1986). Contract AC05-84OR21400.

The US-USSR Weddell Polynya Expedition generated chemical data near the outflow region of the Weddell Sea in the late winter/early spring. These data allowed investigation for the first time of the cumulative winter effects on the distribution of chemical properties in the Weddell Sea surface water. Temperature, salinity, oxygen, and nutrient data all indicate that the temperature-minimum layer found in summer is the remnant winter surface water. In summer, solar heating and melting of sea ice transform the top layer of the winter surface water into a warmer, less saline water than the winter surface water which in summer is partially preserved beneath the top layer. Subsequently, biological activity reduces the nutrient concentration in the summer surface layer. The average amount of soft tissue production in the surface layer above the temperature-minimum layer is about 22.5 micromoles per kilogram. This value translates to a productivity of 300-450 milligrams per square meter per day between late winter and summer if one assumes average surface layer to be 100 meters thick. The average calcium carbonate productivity is 33-50 milligrams per square meter per day. Although the effect of melt water in summer would decrease the estimated productivity by about 2%, the effect of air-to-sea transport of carbon dioxide would probably offset the melt-water effect. The estimated productivity supports the notion that the productivity is indeed high in the southern oceans. Even if one assumes that the average yearly productivity is reduced by half as a result of the winter ice cover, one still has a high organic carbon productivity of 55-82 grams per square meter per year and calcium carbonate productivity of 6-9 grams per square meter per year. These values agree very well with the result, 54 and 7.6 grams per square meter per year, respectively, obtained from the recent sediment trap experiments in the southern oceans.

45899 **Surface-water chemistry in the wintertime southwest Indian Ocean.** Chen, C.T.A. (National Sun Yat-Sen Univ., Kaohsiung (Taiwan)). *Antarctic Journal of the United States;* 21: No. 5, 130-131(1986). Contract AC05-84OR21400.

In the 1984 austral winter (July), the first cruise of the joint French-US INDIVAT (Indien Valorisation de Transite) program was successfully accomplished. Surface data were collected during transit from La Reunion to Crozet, Kerguelen, Amsterdam Island and back to La Reunion Aboard the French antarctic research/supply vessel Marion Dufresne. The subtropical front was found to be near 40°S and the antarctic front was near 47°S during INDIVAT 1. Many chemical properties, especially when normalized to a constant salinity to remove the effects of evaporation and precipitation, are known to correlate linearly with temperature. This paper reports normalized values for nitrate, alkalinity, pH, and carbon dioxide. Production of organic carbon as soft tissue is also discussed.

64 PHYSICS I

REFER ALSO TO CITATION(S) 45984

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 45920, 45921, 46095

45899 **(AD-A—192641/9/XAB) Multi-thermal observations of newly formed loops in a dynamic flare.** Svestka, Z.F.; Fontenla, J.M.; Machado, M.E.; Martin, S.F.; Neidig, D.F. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1987. 16p. (AFGL-TR—88-0089). NTIS, PC A03/MF A01.

Pub. in Solar Physics, Vol. 108, 237-250(1987).

The dynamic flare of 6 November, 1980 (max about 15:26 UT) developed a rich system of growing loops which could be followed in Hα for 1.5 hr. Throughout the flare, these loops, near the limb, were seen in emission against the disk. Theoretical computations of deviations from LTE populations for a hydrogen atom reveal that this requires electron densities in the loops close to, or in excess of 10^{12}/cc. From measured widths of higher Balmer lines the density at the tops of the loops was found to be 4×10^{12}/cc if no non-thermal motions were present, or 5×10^{12}/cc for a turbulent velocity of about 12 km/s. It is now general knowledge that flare loops are initially observed in X-rays and become visible in Hα only after cooling. For such a high density, a loop would cool through radiation from 10 million to 10 thousand within a few minutes so that the dense Hα loops should have heights very close to the heights of the x-ray loops. This, however, contradicts the observations obtained by the HXIS and FCS instruments on board SMM which show the x-ray loops at much higher altitudes than the loops in Hα. The density must have been significantly lower when the loops were formed and that the flare loops were apparently both shrinking and increasing in density while cooling.

45900 **(AD-A—192643/5/XAB) Observation of the total solar eclipsis.** Koutchmy, S. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Mar 1987. 14p. (In French). (AFGL-TR—88-0086). NTIS, PC A03/MF A01.

Pub. in Revue du Palais de la Decouverte, Vol. 15, No. 146, 6-17(Mar 1987).

A brief historical account of the solar-total-eclipses events is presented to show their importance, including their use for the scientific analysis of the solar corona, since 1848. The main parameters and a schema of the eclipses are given. Several examples of investigations performed during a solar total eclipse are discussed.

45901 **(AD-A—192644/3/XAB) Solar granulation. 2. Photographic and photoelectric analysis of photospheric intensity fluctuations at the meso-granulation scale.** Koutchmy, S.; Lebecq, C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1986. 7p. (AFGL-TR—88-0085). NTIS, PC A02/MF A01.

Pub. in Astronomy and Astrophysics, Vol. 169, 323-328(1986).

A statistical analysis of the intensity fluctuations of the solar photosphere, recorded photoelectrically, shows the influence of both seeing effects and especially the 5-min oscillations when intensity fluctuations at scales larger there the scale of the granulation are considered. A one-dimensional photoelectric set of records was time-averaged in order to show the existence of quasi-stationary cells in the range 5' - 50', with amplitude modulations of up to + or - 30 K. The photographic processing of a 23-min time sequence of excellent granulation pictures also showed the existence of cells of quasi-stationary intensity modulations. The amplitudes and stationary nature are larger for larger sizes, but the existence of cells at the meso-granulation scale is fully confirmed.

45902 **(BNL—41423) Summary for astrophysics and non-accelerator physics.** Kahana, S.H. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-8805142—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013782/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

This paper summarizes the presentations at the astrophysics and non-accelerator physics conference. Discussed in this paper are: supernovae, neutrinos, x-rays, gamma rays, cosmic rays, monopoles and primordial nucleosynthesis. 15 refs. (LSP)

45903 **(DOE/ER/03130—T16) Progress report for a research program in theoretical high energy physics.** Feldman, D.; Fried, H.M.; Jevicki, A.; Kang, Kyungsik; Tan, Chung-I. (Brown Univ., Providence, RI (USA). Dept. of Physics). 30 Jun 1988. Contract AC02-76ER03130. 23p. (COO—313OTA-406; BROWN/HET—670). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012766/JAW.

This year's research has dealt with: galaxy and cluster from formation with and proton decay catalyzed by cosmic strings; dynamics of inflationary models; the contraction of gauge groups; the narrow e+ e/sup {minus}/ and two photon peaks in heavy ion scattering; the application of the strong coupling-by-infrared extraction method and the strong coupling approximation or ordered exponentials; the operator construction of the interacting superstring theory; S-matrix formalism for the effective action in strings; general σ-model with general non-renormalizable interactions; gauge models that include the axion and majoron; high energy hadron-hadron scattering models; axion emission from supernova; flavor symmetry and mixings; a nonperturbative study of QCD; finite-temperature structure of superstring theories; rising total cross-sections in the dual parton model; a new class of solutions to the open-bosonic-string field equations; tachyons and perturbative unitarity; closed string field theory from an on-shell effective action; 2-dimensional conformal field theories and non-linear σ-models describing strings. 16 refs.

45904 **(DOE/ER/03130—T19) Progress report for a research program in physics of the early universe.** Brandenberger, R.H. (Brown Univ., Providence, RI (USA). Dept. of Physics). 30 Jun 1988. Contract AC02-76ER03130. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012764/JAW.

Since September 1987 most of my research has been devoted to early universe cosmology. The three focal points have been investigating galaxy and cluster formation with cosmic strings, proton decay catalyzed by cosmic strings, and dynamics of inflationary universe models.

45905 **(INIS-mf—11260, pp 25) SN 1987 - Astrophysical aspects.** Wehrse, R. (Heidelberg Univ. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45906 **(INIS-mf—11267) Tenth European regional astronomy meeting of the IAU. Abstracts.** (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). [27 Oct 1987]. 120p. (CONF-8708269—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703273/JAW.

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The conference met in 13 sessions. Session 1: "Development of active solar regions" included papers on sunspots, the photometry thereof, the diagnostics of radio waves of active solar regions, etc. Session 2: "The complex of interplanetary bodies" included papers on interplanetary dust, meteors, asteroids and comets. Session 3 dealt with resonance in the solar system. Papers presented in the session "Structure of galaxies and star formation" dealt with the problems of the development of stars and galaxies and their properties immediately after formation. The session: "Rapid variability of single, binary and multiple stars" contained papers on star observation and star activity. In other sessions participants heard papers on ultraviolet star spectra, cosmology and the formation of galaxies, high-energy astrophysics, active extragalactic objects and binary stars. (E.S.).

45907 **(LA-UR—88-1282) Extraction of light gasses from Mars or its moons.** Vaniman, D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-880843—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009123/JAW.

From SPACE conference; Albuquerque, NM, USA (29 Aug 1988).

The light elements H, C, N, O and S are important for propellant production and life support in space. These light elements occur on Mars, and may occur on the martian moons Phobos and Deimos, in forms that would allow their collection as gasses. The martian north pole apparently contains large amounts ({approximately}10^{13} MT) of H_2O but has not been probed or sampled. The martian atmosphere is relatively well known; a MW-scale plant could produce 1000 MT of O_2 per Earth-year by dissociation of CO_2 from the martian atmosphere. A plant of about 3 MW power might produce 1000 MT of H_2 plus O_2 per Earth-year by extracting and dissociating water from the martian moons (if they are chondritic), but more data and process development are needed before such a plant can be considered with certainty. 5 refs., 2 tabs.

45908 **(PB—88-212766/XAB) Solar-Geophysical Data Number 523, March 1988. Part 1 (prompt reports). Data for February 1988, January 1988, and late data.** Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Mar 1988. 114p. (SGD—523-PT-1). NTIS, PC A06/MF A01.

See also Number 523, Part 2, PB—88-212774, and Number 521, Part 1, PB—88-179213.

Contents include: Data for February 1988; IUWDS alert periods (Advance and worldwide); Solar activity indices; Solar flares; Solar radio emission; Stanford mean solar magnetic field; VOSTOK inferred interplanetary magnetic field.

45909 **(PB—88-212774/XAB) Solar-Geophysical Data Number 523, March 1988. Part 2 (comprehensive reports). Data for September 1987, and miscellanea.** Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Mar 1988. 64p. (SGD—523-PT-2). NTIS, PC A04/MF A01.

See also Number 523, Part 1, PB—88-212766, and Number 521, Part 2, PB—88-179221.

Contents include: Data for September 1987; Meudon Carte synoptique; Solar flares; Solar radio bursts at fixed frequencies; Solar x-ray radiation from GOES satellite (Graphs); Mass ejections from the sun; Active prominences and filaments.

45910 **Nature of the interior of Uranus based on studies of planetary ices at high dynamic pressure.** Nellis, W.J.; Hamilton, D.C.; Holmes, N.C.; Radousky, H.B.; Ree, F.H.; Mitchell, A.C.; Nicol, M. (Lawrence Livermore National Lab., CA (USA)). *Science (Washington, D.C.);* **240**: 779-781(6 May 1988). Contract W-7405-ENG-48.

Data from the Voyager II spacecraft showed that Uranus has a large magnetic field with geometry similar to an offset tilted dipole. To interpret the origin of the magnetic field, measurements were made of electrical conductivity and equation-of-state data of the planetary ices ammonia, methane, and synthetic Uranus at shock pressures and temperatures up to 75 gigapascals and 5000 K. These pressures and temperatures correspond to conditions at the depths at which the surface magnetic field is generated. Above 40 gigapascals the conductivities of synthetic Uranus, water, and ammonia plateau at about 20 $(ohm\text{-}cm)^{-1}$, providing an upper limit for the electrical conductivity used in kinematic or dynamo calculations. The nature of materials at the extreme conditions in the interior is discussed. 29 references, 3 figures.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 45920

45911 **(AD-A—192256/6/XAB) Recombination in the normal E and F layers of the ionosphere.** Bates, D.R. (Queen's Univ., Belfast, Northern Ireland (UK). Dept. of Applied Mathematics and Theoretical Physics). 1988. 10p. NTIS, PC A02/MF A01.

Pub. in Planetary and Space Science, Vol. 36, No. 1, 55-63(1988).

The rather curious way in which the theory of recombination in the normal E and F layers of the ionosphere developed is described. The history illustrates how a correct theory may grow from false experimental results. The position has been dramatically changed by studies using the St Santin incoherent scatter radar. Monro et al. (1976) deduced from such a study that, in direct conflict with what had been inferred from ionograms, n(e) is greater in the morning than at the corresponding time in the afternoon. Senior et al. (1981) confirmed this from measurements of the integrated Hall conductivity through the E region. They suggested that the n(e) asymmetry is a nitric oxide effect. As they recalled, Atmosphere Explorer measurements by Stewart and Cravens (1978) have shown that n(NO) in the lower E region increases throughout the greater part of the day (by a factor of about two at the equator). Gerard and Taieb (1986) have recently reported further measurements with the St Santin incoherent-scatter radar on the diurnal variation of n(e) in the E region. They found that the morning values usually exceeded the afternoon values by between 3% and 20% but occasionally by more. The asymmetry factor may indeed exceed that which would occur if there were only O_2 ions in the morning and only NO ions in the afternoon, showing that an effect other than the nitric oxide effect enters. Tides produce asymmetries in diurnal variation of the properties of the atmosphere.

45912 **(AD-A—192270/7/XAB) High-latitude ionospheric radio studies. Final report, 3 May 1983-30 September 1986.** Reinisch, B.W.; Bibl, K.; Dozois, C.G.; gamache, R.R.; Kitrosser, D.F. (Lowell Univ., MA (USA). Center for Atmospheric Research). Jan 1988. 165p. (ULRF—439/CAR). NTIS, PC A08/MF A01.

Structure and dynamics of the ionosphere are explored under this contract by digital high-frequency sounding techniques. The research emphasizes the investigation of the auroral and subauroral ionosphere, but also includes studies on the polar-cap and mid-latitude ionosphere.

45913 **(AD-A—192381/2/XAB) Rocket measurements within a polar cap arc: ionospheric modeling.** Sheehan, R.E. (Boston Coll., Chestnut Hill, MA (USA)). 19 Nov 1987. 34p. (SCIENTIFIC—2). NTIS, PC A03/MF A01.

Precipitating-electron fluxes measured over a polar cap, F-region auroral arc were input to an ionospheric model that calculates production rate and density profiles of various species. The model also finds the electron temperature and electric conductivities over a specified altitude range. Most model results compare favorably with rocket measurements taken near apogee over the arc. The actual electron temperature is underestimated by the model and the relative densities of some minor species do not agree. Model results show that initial density conditions in particular strongly affect the development of electron-density enhancements produced by dynamic, short-lived (15 min) fluxes of soft electrons. The neutral atmosphere chosen for the model also influences the electron-density profile produced by soft fluxes. Such differences may play a role in the solar-cycle dependence of density fluctuations that cause scintillations in the polar cap.

45914 **(AD-A—192846/4/XAB) MAXIE-1 (Magnetospheric Atmospheric X-ray Imaging Experiment). Progress report, 1 January-31 March 1988.** Imhof, W.L.; Voss, H.D.; Chinn, V. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Space Sciences Lab.). 23 Mar 1988. 6p. (LMSC/F—247006). NTIS, PC A02/MF A01.

The satellite flight of the MAXIE-1 (Magnetospheric Atmospheric X-Ray Imaging Experiment) instrument is being implemented under ONR (the Office of Naval Research) sponsorship. The MAXIE-1 instrument is being developed as a joint activity of Lockheed, the Aerospace Corporation, and the University of Bergen; much of the Lockheed development has been done under the Independent Research Program. Under ONR sponsorship, that institution is responsible for managing the program, for providing spacecraft interface requirements, for providing interface electronics for conditioning sensor signals, for developing test software, and for conducting environmental tests needed for flight. This report describes some of the interface activities undertaken in the last three months, including the Interface Critical Design Review. Interactions have continued with co-investigators at the Aerospace Corp. and at the University of Bergen. A common board has been designed to condition spacecraft signals so as to make them compatible with the MAXIE instrument and vice-versa for the MAXIE signals. A breadboard of this common board has been fabricated and tested.

45915 **(AD-A—192918/1/XAB) Monte Carlo modeling of oxygen-ion conic acceleration by cyclotron resonance with broadband electromagnetic turbulence.** Retterer, J.M.; Chang, T.; Crew, G.B.; Jasperse, J.R.; Winningham, J.D. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1987. 16p. NTIS, PC A03/MF A01.

Pub. in Physics of Space Plasmas (1985-7), Vol. 6, 97-111(Nov 1987).

Cyclotron resonance with observed electric-field fluctuations is demonstrated to be responsible for production of the oxygen-ion conics that are observed by the DE-1 satellite in the CPS region of the Earth's auroral zone. The ion velocity distribution is described by a quasi-linear diffusion equation solved using the Monte Carlo technique. The acceleration produced by the observed wave spectrum agrees well with the ion observations, in both form and magnitude. To the authors knowledge, this represents the first successful comparison of an observed conic with any theoretical model.

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REFER ALSO TO CITATION(S) 45745, 45971, 46170

45916 **(AD-A—192248/3/XAB) Electron-impact-ionization and electron-attachment cross sections of radicals important in transient gaseous discharges. Annual report, 1 September 1986-31 December 1987.** Lee, L.C.; Wang, D.P.; Srivastava, S.K. (San Diego State Univ., CA (USA). Dept. of Electrical and Computer Engineering). 5 Feb 1988. 53p. NTIS, PC A04/MF A01.

In this research program, an apparatus using an electron beam, laser beam, and molecular beam was constructed to measure the electron-impact-ionization cross sections and electron-attachment cross sections of radicals that are abundant in electrical-discharge media. The electron excitation cross sections of radicals are very little known. The radical data are needed for understanding the microscopic processes of electrical discharges and for designing gaseous-discharge switches. High-power gaseous-discharge switches are currently needed for the development of inductive-energy-storage systems, high-power lasers, and particle-beam experiments.

45917 **(AD-A—192505/6/XAB) Study of energy levels and decay mechanisms for singlet Rydberg states of molecular nitrogen. Final report for 1 October 1983-1 August 1987.** Pipkin, F.M. (Harvard Univ., Cambridge, MA (USA)). 15 Sep 1987. 52p. NTIS, PC A04/MF A01.

This report summarizes a series of investigations of the singlet Rydberg states of molecular nitrogen. The objective of the research was to use laser excitation out of a metastable singlet state in N_2 to study the energy levels and decay mechanisms for the high-lying singlet Rydberg and valence states. The first section summarizes the current knowledge of these states. The second section describes the initial attempts to produce a beam of molecules in the a'(0)1 epsilon +g state and use laser excitation to gain access to higher-lying singlet states.

45918 **(AD-A—192558/5/XAB) Rate constants for the deactivation of the 15-micrometer band of carbon dioxide by the collision partners CH_3F, CO_2, N_2, Ar and Kr over the temperature range 300 to 150K.** Lunt, S.L.; Wickham-Jones, C.T.; Simpson, C.J. (Oxford Univ. (UK). Physical Chemistry Lab.). 22 Mar 1985. 6p. NTIS, PC A02/MF A01.

Pub. in Chemical Physics Letters, Vol. 115, No. 1, 60-64(22 Mar 1985).

Rate constants were measured for the vibrational deactivation of the 15-micrometer band of carbon dioxide in the temperature range 300 to 150 K by the collision partners CH_3F, CO_2, N_2, Ar, and Kr. The CO_2 was vibrationally excited by (VV) transfer from CH_3F which had been pumped with a CO_2 laser and its deactivation monitored using IR fluorescence.

45919 **(AD-A—192559/3/XAB) Experimental and theoretical study of the v yields t,r relaxation of CD_4 between 300 and 100K.** Gregory, E.A.; Buckingham, M.R.; Clayton, D.Z.; Wolfenden, F.J.; Simpson, C.J. (Oxford Univ. (UK). Physical Chemistry Lab.). Feb 1984. 6p. NTIS, PC A02/MF A01.

Pub. in Chemical Physics Letters, Vol. 104, No. 4, 394-397(10 Feb 1984).

The values of the rate constants for the relaxation of the lowest vibrational modes of methane (CH_4) and CD_4 are of interest as they provide evidence for the relative importance of rotation in these processes. Some data exist for the lowest vibrational modes of CD_4 at room temperature and for its self-deactivation between 376 and 140 K. There is, however, a paucity of low-temperature data concerning its deactivation by different collision partners. We have measured rate constants for various collision partners deactivating the bending modes of CD_4 between 300 and 100K. The experimental method used is the laser fluorescence technique in which excitation of the bending modes of CD_4 is achieved by collisionally pumping CD4 with CO. The results have been interpreted in terms of a theoretical model which is based on SSH theory and therefore calculates the probability of energy transfer per collision. The theory has been modified to include a contribution for the rotational motion of both collision partners in addition to their relative translational motion.

45920 **(AD-A—192741/7/XAB) Recombination.** Bates, D.R. (Queen's Univ., Belfast, Northern Ireland (UK). Dept. of Applied Mathematics and Theoretical Physics). 1988. 11p. NTIS, PC A03/MF A01.

Pub. in Electronic and Atomic Collisions, 3-12(1988).

An account is given of how investigations on the Earth's ionosphere and the solar corona led to the discovery of several recombination processes (dissociative, dielectronic, and mutual neutralization). While most branches of atomic-collision physics have been influenced by atmospheric and astrophysical studies, it is to be doubted if any has been influenced as much as has the twig, recombination. Such studies are largely responsible for the recognition of the remarkable diversity of the paths by which recombination of oppositely charged systems may take place. In general, theorists did not envisage new reaction paths until driven by the pressure of enigmatic observations. It is worth recalling some of the history partly because although history never repeats itself it occasionally rhymes. The author first considers the Earth's ionosphere, and then, very briefly, the solar corona.

45921 **(AD-A—192742/5/XAB) Interstellar cloud chemistry revisited.** Bates, D.R. (Queen's Univ., Belfast, Northern Ireland (UK). Dept. of Applied Mathematics and Theoretical Physics). 1987. 28p. NTIS, PC A03/MF A01.

Pub. in Recent studies in Atomic and Molecular Processes, 1-27(1987).

Simple chemical processes can explain much of the observation of interstellar matter. This paper presents a review of some of

these elemental processes with emphasis on electron-ion recombination, ion-neutral collision, and radiative association reaction.

45922 **(AD-A—192876/1/XAB) Measurement and rate-law analysis of D_2 Q-branch line-broadening coefficients for collisions with D_2, He, Ar, H_2, and CH_4.** Smyth, K.C.; Rosasco, G.J.; Hurst, W.S. (National Bureau of Standards, Washington, DC (USA)). 15 Jul 1987. 13p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Chemical Physics, Vol. 87, No. 2, 1001-1011(15 Jul 1987).

Continuous-wave stimulated Raman spectroscopy was used to obtain high-resolution vibrational Q-branch spectra at room temperature for pure deuterium 2 and D_2:He, D_2:H_2, D_2:Ar, and D_2:CH_4 mixtures. Measurements were made for J=0-5 in the density region of 0.5-20.0 amagat, from which line-broadening coefficients were determined. These coefficients were analyzed using a modified exponential energy-gap rate law to identify the contributions of rotationally inelastic collisions and vibrational dephasing collisions to the line width. This analysis assumed that vibrational dephasing is independent of rotational state, in accord with available theoretical studies. Results are compared with experimental and theoretical work on H_2, HD, and D_2, thereby characterizing the contributions of rotationally inelastic and vibrational dephasing collisions to the line-broadening coefficients as a function of both rotational level and collision partner.

45923 **(ATOMKI-B—22(1987)) Multiple ionization and multiple vacancy production in heavy-ion - Ne collisions. An experimental study.** Kadar, I.; Ricz, S.; Sulik, B.; Varga, D.; Vegh, J.; Berenyi, D. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1987. 10p. (CONF-8708135—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703098/JAW.

From 3. workshop on high energy ion-atom collisions; Debrecen, Hungary (3 Aug 1987).

Electron ionization and vacancy production probability values are given for the L-shell of neon in several heavy-ion - Ne collisions at small impact parameter. The principles of the evaluation of ionization and vacancy production probability values are discussed. Total L-shell vacancy distribution produced simultaneously with K-shell vacancy production is given for the 5.5 MeV/u Ne/sup 3+/ - Ne and Ne/sup 10+/ - Ne collisions compared to the binomial distribution. From this comparison it seems to be probable that L to L charge transfer plays a non-negligible role in the Ne/sup 10+/ - Ne collision at small impact parameter values. (author) 7 refs.; 7 figs.

45924 **(ATOMKI-B—23(1987)) Angular distribution of the neon K-Auger satellites in heavy ion-atom collisions.** Ricz, S.; Vegh, J.; Kadar, I.; Sulik, B.; Varga, D.; Berenyi, D. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1987. 8p. (CONF-8708135—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703099/JAW.

From 3. workshop on high energy ion-atom collisions; Debrecen, Hungary (3 Aug 1987).

Using a series of spectra excited by different heavy ion projectiles in different charge states the identification and the angular distribution of several Auger lines are determined. For some transitions the presence of the A/sub 4/ term in the angular distribution is demonstrated. The alignment parameter calculated for states of type /sup 1/P,/sup 3/P does not depend on the number of electrons in the target, while a rather strong dependence on the projectile Z number was found. (author) 14 refs.; 5 figs.

45925 **(BNL—41378) Extraction of a steady state electron beam from HCD [hollow cathode discharge] plasmas for EBIS [electron beam ion source] applications.** Hershcovitch, A.; Kovarik, V.; Prelec, K. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-880695—25). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013788/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Experiments to extract high brightness electron beams from hollow cathode discharge plasmas are now in progress. A unique feature of these plasmas, which in principle can facilitate the extraction of large current low emittance electron beams, is the existence of a relatively high energy electron population with a very narrow energy spread. This electron population was identified in a self-extraction experiment, which yielded a 35 eV, 600 mA electron beam with parallel energy spread of less than 0.5 eV. Preliminary, crude application of 2.5 kV extraction voltage yielded a steady state electron beam current of 1.2 A. The end result of this endeavor would be an Electron Beam Ion Source (EBIS) with an electron beam current of 6 A. 4 refs., 2 figs.

45926 **(CONF-880715—1) Atom-pair correlations in Fe-13.5% V.** Cable, J.W.; Child, H.R.; Nakai, Y. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012483/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

Diffuse neutron scattering data were used to determine the atom-pair correlations for Fe-13.5% V in terms of both the Warren-Cowley ASRO parameters and the Krivoglaz-Clapp-Moss pair-potentials. These agree reasonably well with those calculated by Hennion from alloy band structure parameters. 9 refs., 2 figs., 1 tab.

45927 **(CONF-880771—1) Mass spectrometric probes of metal cluster distributions and metastable ion decay.** Parks, E.K.; Liu, K.; Cole, S.K.; Riley, S.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011952/JAW.

From 36. American Society Mass Spectrometry (ASMS) conference on mass spectrometry and allied topics; San Francisco, CA, USA (5 Jul 1988).

The study of metal clusters has provided both an opportunity and a challenge to the application of mass spectrometry. These days the most often-used technique for cluster generation - laser vaporization - leads to extensive distributions of cluster sizes, from one to perhaps thousands of atoms, and most studies reported to date use excimer laser ionization and time-of-flight mass spectrometry for cluster detection. Our apparatus is a simple one-stage TOF design employing Wiley-McLauren spatial focusing and a one-meter drift tube. In a second apparatus employing a pulsed valve in the cluster source, we see asymmetric broadening of niobium cluster mass peaks under multiphoton ionization conditions, indicating metastable decay of parent cluster ions. Other studies of niobium clusters have shown no such asymmetric peaks. 2 figs.

45928 **(DOE/ER/13405—3) Picosecond CO_2 laser interactions with polyatomic molecules: Progress report, July 15, 1986-July 14, 1988.** Kwok, H.S. (State Univ. of New York, Buffalo (USA). Dept. of Electrical and Computer Engineering). 10 Feb 1988. Contract FG02-85ER13405. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013822/JAW.

During the past two years of this research program, significant advances have been made on the understanding of the process of intramolecular energy redistribution (IVR) in the vibrational quasicontinuum of polyatomic molecules. Two approaches for this experimental program were employed. They were IR-IR double resonance absorption spectroscopy and vis-IR multiphoton ionization spectroscopy. In both cases, significant results were obtained. In particular, it was found that the collisionless IR absorption spectra of vibrationally excited molecules are dependent on the probe pulse duration. For very short 20 ps pulse, the absorption spectra have very clean Lorentzian lineshapes with zero absorption away from the line center. For longer pulses, the entire spectra broaden and a constant background absorption emerges. This result indicates that the absorption is confined to narrow line for short times, and other lines contribute to absorption at longer interaction times. It implies that nonstatistical or even mode selective chemistry is possible on these short timescales. Using multiphoton ionization spectroscopy it was found that the strong coupling of the ground electronic state and the first excited electronic state resulted in ultrafast internal energy conversion in $CrO_2C\{ell\}_2$. By selectively pumping different vibrational lines in the excited state, a rapidly in-

creasing coupling was measured as the vibrational quantum number increased. This new class of experiment is different from our previous ps CO_2 laser pulse experiments in the sense that state-state specific energy relaxation is studied. 4 figs.

45929 **(GSI—88-22-Prepr.) Angular correlations of coincident electron-positron pairs produced in heavy-ions collisions with nuclear time delay.** Graf, O.; Reinhardt, J.; Mueller, B.; Greiner, W.; Soff, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Mar 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754157/JAW.

We investigate angular correlations between coincident electron-positron pairs emitted in heavy ion collisions with nuclear time delay. Special attention is directed to a comparison of supercritical and subcritical systems, where angular correlations of pairs produced in collisions of bare U-nuclei are found to alter their sign for nuclear delay times of the order of 2x10/sup -21/ s. This effect is shown to occur exclusively in supercritical systems, where spontaneous positron creation is active.

45930 **(GSI—88-23-Prepr.) Positron creation in heavy ion collisions: The influence of the magnetic field.** Soff, G.; Reinhardt, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics; Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Mar 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754158/JAW.

We calculate the creation of positrons in heavy-ion collisions including the influence of the magnetic dipole field produced by the moving nuclei. Contrary to a recent claim we find no narrow structures in the positron energy spectrum.

45931 **(INIS-BR—1172) Scattering of low-energy electrons by gas-phase (H/sub 2/O) and oriented (H/sub 2/) molecules.** Brescansin, L.M.; Lima, M.A.P.; Mckoy, V.; Hwo, W. (California Inst. of Tech., Pasadena (USA); Notre Dame Univ., IN (USA). Radiation Lab.). (California Inst. of Tech., Pasadena (USA)). 1985. 1p. (CONF-8512147—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703574/JAW.

From 3. Brazilian symposium on theoretical chemistry; Sao Carlos, Brazil (9 Dec 1985).

45932 **(INIS-BR—1174) Study of discreet excitement in argon atom by electron impact.** Souza, G.G.B. de; Roberty, H.M.B.; Lucas, C.A.; Bielschowsky, C.E. (Rio de Janeiro Univ. (Brazil). Inst. de Quimica). 1985. 1p. (CONF-8512147—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703576/JAW.

From 3. Brazilian symposium on theoretical chemistry; Sao Carlos, Brazil (9 Dec 1985).

45933 (INIS-mf—11260, pp 62) **High resolution measurement of the CuKα x-ray satellite spectrum.** Maskil, N.; Deutsch, M. (Bar-Ilan Univ., Ramat-Gan (Israel)). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45934 (INIS-SU—40/A, pp 42-50) **Spectrometry of characteristic X-ray at hydrogen-like ion neutralization Kr/sup +35/.** Vagner, V.; Donets, E.D.; Dunin, V.B.; Kartashov, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW. (N—4(24)-87).

In JINR rapid communications. Collection.

By the crystal-diffraction method an experimental on the research of X-ray radiation, when Kr/sup +35/ is neutralized on the solid body, was carried out. The presence of the structure in the spectrum of characteristic radiation, where the K-shell fill-up process is a dominating one for the number of vacancies in L-shell being 6 and 7 is registered. 12 refs.; 4 figs.

45935 **(JINR—R-11-87-459) Program for calculation of energy levels and wave functions of hydrogen mesic molecules in adiabatic representation of the three-body problem.** Gocheva, A.D.; Puzynin, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702942/JAW.

The description of BSMADM program package for numerical solution of a particular Sturm-Liouville problem is presented. This problem arises in the calculation of energy levels and wave functions of bound states of three particles with Coulomb interaction in adiabatic representation. The program package was used for calculating characteristics of weakly bound states of mesic molecules $dd\mu$ and $dt\mu$ which are of main interest for muon-catalysed fusion. 8 refs.; 2 tabs.

45936 **(LA-UR—88-2508) LMTO [Linear Muffin-Tin Orbital] electronic band-structure calculations for linear Pt-Br chains.** Albers, R.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880669—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014404/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Self-consistent first-principles Linear Muffin-Tin Orbital (LMTO) scalar-relativistic and Dirac-relativistic electronic band structure calculations are presented for linear Pt-Br chains (without any ligand structure) embedded in a three-dimensional crystal with empty atomic spheres added to isolate the chains. These calculations are a first step towards a complete a priori calculation of the electronic structure of the halogen-bridged linear platinum chain compound $Pt_2Br_6(NH_3)_4$, an MX chain compound (M = transition metal and X = halogen atoms). 10 refs., 4 figs.

45937 **(LBL—8012074) μSR newsletter No. 34.** Crowe, K.M.; Portis, A.M.; Yamazaki, T. (eds.). (Lawrence Berkeley Lab., CA (USA); Tokyo Univ. (Japan). Meson Science Lab.). 5 Jun 1988. Contract AC03-76SF00098. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012074/JAW.

This newsletter contains the following papers: Diffusion and Localization of Positive Muons and Pions in Copper; Muonium Atoms Compared to Hydrogen Atoms and Hydrated Electrons Through Reactions with Nitrous Oxide and 2-Propanol; Micelle-induced Enhancements of the Reactivity of Muonium Atoms in Dilute Aqueous Solutions; Spin Depolarization by Diffusion on Lattices; and Spin Depolarization of a Quantum Particle on a Linear Chain with Alternating Larmor Frequencies. (FI)

45938 **(OUP—88-04) L-shell ionisation in very asymmetric ion-atom collisions.** Aashamar, K.; Amundsen, P.A. (Oslo Univ. (Norway). Fysisk Inst.; Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). (Oslo Univ. (Norway). Fysisk Inst.). Apr 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754483/JAW.

Expressions are derived for the path factors for arbitrary multipole transitions for a Rutherford trajectory in the semiclassical approximation for atomic ionisation. The usefulness of the method is illustrated by calculating L subshell ionisation for light ion impact on heavy atoms, including electronic relativistic effects and a realistic atomic target potential.

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REFER ALSO TO CITATION(S) 45302, 46082

45939 (AD-A—192285/5/XAB) MACH2: a two-dimensional magnetohydrodynamic simulation code for complex experimental configurations. Interim report. Frese, M.H. (Mission Research Corp., Albuquerque, NM (USA)). Sep 1987. 93p. (AMRC-R—874). NTIS, PC A05/MF A01.

MACH2 is a flexible and powerful two-dimensional magnetohydrodynamic simulation code designed specifically to handle complex experimental configurations. The code's capabilities include a numerically generated solution-adaptive grid which permits it to be used for either Eulerian or Lagrangian flow problems, use of real equations of state and transport properties from the Los Alamos National Laboratory SESAME package, and a multigrid implicit magnetic field diffusion solver that can be used to simulate problems with vacuum. The descriptive power of the namelist-based problem input language is sufficient that no code modifications are required to set up any of a broad class of problems. Almost no knowledge of the internal data structures and numerical techniques is required to do simulations that realistically model complex experiments. This is made possible by the code's multiblock architecture and table-driven control structure. Code reliability and flexibility are ensured and enhanced by a structured and modular implementation of boundary conditions and block coupling. This report details the physical model, including boundary conditions; permissible problem geometries; time differencing; and spatial discretization, centering, and differencing of MACH2.

45940 (AD-A—192506/4/XAB) Nonlinear analysis of non-neutral plasmas. Report for 1 October 1986-30 September 1987. Ayres, V.M. (Naval Surface Warfare Center, Silver Spring, MD (USA)). 30 Sep 1987. 35p. (NSWC-TR—87-340). NTIS, PC A03/MF A01.

The purpose of this investigation is to incorporate nonlinear effects into the analysis of non-neutral plasma beams in order to accurately estimate their performance in realistic situations. Intense non-neutral plasma beams have important applications for DEW, SDI, high power microwave/millimeter wave production, and particle-beam guidance systems.

45941 (AD-A—192745/8/XAB) Internal and external laser-induced avalanche breakdown of single droplets in an argon atmosphere. Report for February-June 1987. Hsieh, W.; Eickmans, J.H.; Chang, R.K. (Yale Univ., New Haven, CT (USA). Dept. of Applied Physics). Nov 1987. 6p. NTIS, PC A02/MF A01.

Pub. in Jnl. of the Optical Society of America B, Vol. 4, No. 11, 1816-1820(Nov 1987).

Laser-induced breakdown of a transparent micrometer sized H_2O droplet can be initiated only in the Ar gas in a strip outside the droplet shadow face. At a higher-input 0.532-micrometer Q-switched laser intensity, breakdown can also occur within the droplet. The resultant internal plasma blocks the laser from reaching the region outside the shadow face and absorbs more of the laser pulse to produce a shock wave and/or a laser-supported detonation wave. Various combinations of liquid and surrounding gas were investigated at different input intensities in order to provide information on the breakdown processes in a transparent droplet.

45942 (AD-A—192747/4/XAB) Propagation velocity of laser-induced plasma inside and outside a transparent droplet. Report for November 1986-February 1987. Hsieh, W.; Zheng, J.; Wood, C.F.; Chu, B.T.; Chang, R.K. (Yale Univ., New Haven, CT (USA). Dept. of Applied Physics). Aug 1987. 4p. NTIS, PC A02/MF A01.

Pub. in Optics Letters, Vol. 12, No. 12, 576-578(Aug 1987).

The supersonic propagation velocity of the emission front of plasma produced by laser-induced breakdown of a micrometer-sized transparent droplet flowing in a gas was measured with a streak camera at three intensity levels. At low input intensity, the plasma velocities in the gas away from and toward the shadow face were determined. At medium input intensity, the plasma velocities in the gas outside the shadow face and within the liquid (traveling toward the illuminated face) were measured. At high input intensity, the plasma velocities in the gas outside the shadow face, within the liquid, and in the gas outside the illuminated face were deduced.

45943 (AD-A—192884/5/XAB) Theory and simulation of relaxed plasmoids. Final report, 1 September 1986-31 October 1987. Brandenburg, J.; Wahlstrand, K. (Mission Research Corp., Alexandria, VA (USA)). Dec 1987. 27p. (MRC/WDC-R—148). NTIS, PC A03/MF A01.

Plasmoids can be described as a group of electrons and ions that propagate as a unit through vacuum. In their present conception, they consist of an expanding halo region, carrying return current and bearing a slight charge imbalance, and an equilibrium core region that propagates like a pinched charged-particle beam. This model was first suggested by T. Lockner of Sandia. Since they are a type of charged-particle beam, they can be generated with higher efficiency and deposit their energy over a deeper distance in matter than laser beams. This makes plasmoids attractive for defense applications; however, the structure, formation, and propagation of plasmoids in a space environment are not known at present. Theory and one-dimensional simulations aimed at finding the core structure of plasmoids by using variational principles were successful. This report documents the progress made in this first phase of research. A proposed second phase of research will use similar techniques to model the three-dimensional formation and propagation of plasmoids in a space environment.

45944 (LBL—25452) Selected equation of state in the acentric factor system. Schreiber, D.R.; Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 16p. (CONF-880606—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013604/JAW.

From 10. symposium on thermophysical properties; Gaithersburg, MD, USA (20 Jun 1988).

A new equation of state in the acentric factor system is developed on the basis of high-precision data. The region in critical temperature T/sub r/, critical density P/sub r/ space is identified where there is good agreement as well as the regions of significant departures. The equation fits very well in the critical region. 10 refs., 6 figs., 3 tabs.

45945 (ORNL/TM—10747) A preliminary study on the use of magnetohydrodynamic forces to remove impurities from molten metals. Hobson, D.O. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013508/JAW.

Experimental and modeling work on the use of magnetohydrodynamic forces for separating particulate impurities from molten metals is described. Several experimental systems are described, which use ac or dc electromagnets and, thereby, either induced or direct currents to produce the required forces. Recommendations are made for further optimization of the separators. 8 refs., 5 figs., 2 tabs.

45946 (UCRL—98976) Godunov methods and adaptive algorithms for unsteady fluid dynamics. Bell, J.; Colella, P.; Trangenstein, J.; Welcome, M. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 6p. (CONF-8806125—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013094/JAW.

From 11. international conference on numerical methods in fluid dynamics; Williamsburg, VA, USA (27 Jun 1988).

Higher-order versions of Godunov's method have proven highly successful for high-Mach-number compressible flow. One goal of the research being described in this paper is to extend the range of applicability of these methods to more general systems of hyperbolic conversion laws such as magnetohydrodynamics, flow in porous media and finite deformations of elastic-plastics solids. A second goal is to apply Godunov methods to problems involving more complex physical and solution geometries than can be treated on a simple rectangular grid. This requires the introduction of various adaptive methodologies: global moving and body-fitted meshes, local adaptive mesh refinement, and front tracking. 11 refs., 6 figs.

45947 **Mean free paths, viscosity, and the limitations of perfect fluid hydrodynamics in the description of the quark-gluon plasma.** McLerran, L. (Theoretical Physics Dept., Fermilab, P.O. Box 500, Batavia, IL (US)). pp 70-89 of Local equilibrium in strong interaction physics (LESIP I). Scott, D.K.; Weiner, R.M. Teaneck, NJ; World Scientific Pub. Co. (1985). (CONF-8409358—).

From International course on observational and theoretical aspects of relativistic astrophysics and cosmology; Santander, Spain (3 Sep 1984).

The author discusses the applicability of a hydrodynamic description of high energy hadronic collisions. The author reviews the results of recent computations of the mean free paths of quarks and gluons in a quark-gluon plasma, and the corresponding results for viscous coefficients. These quantities are employed to evaluate the limits to the application of perfect fluid hydrodynamics as a description of the time evolution of matter produced in various hardronic collisions.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 45578, 45903

45948 **(DOE/ER/40253—3) Elementary particles and high energy phenomena: Progress report.** Cumalat, J.P. (Colorado Univ., Boulder (USA). Dept. of Physics). 1988. Contract AC02-86ER40253. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012952/JAW.

This paper reviews the research being done at the University of Colorado in High Energy Physics. Topics discussed in this paper are: Charmed Photoproduction; Hadronic Production of Charm Particles; Photoproduction of States Containing Heavy Quarks; Electron-Positron Physics with the MAC Detector at PEP; Electron-Positron Physics with the Upgraded Mark II Detector at SLC; The SLD Detector at SLC; Nonperturbative Studies of QCD; Hadron Phenomenology - Application to Experiment; Perturbative QCD and Weak Matrix Elements; Quarkonium Physics; Supersymmetry, Supergravity, and Superstrings; and Experimental Gravity. 50 refs., 13 figs.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 45947, 45968, 45992

45949 **(CERN-EP—83-144) Xenon time projection chamber for $\beta\beta$ decay.** Bellotti, E.; Cremonesi, O.; Fiorini, E.; Liguori, C.; Ragazzi, S.; Rossi, L.; Traspedini, L.; Zanotti, L. (European Organization for Nuclear Research, Geneva (Switzerland)). 22 Sep 1983. 24p. (CONF-8306139—3). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012583/JAW.

From Time projection chamber workshop; Vancouver, Canada (23 Jun 1983).

The design of a Time Projection Chamber (TPC) fulled with Xe at high pressure is described. The aim of the project is to measure the neutrinoless $\beta\beta$} decay of {sup 136}Xe at the level of 10{sup 23} years. Guidelines for the choices operated in the project and experimental results of prototypes are presented. 22 refs., 10 figs.

45950 **(CERN-EP—87-177) CP violation in K decay.** Mannelli, I. (European Organization for Nuclear Research, Geneva (Switzerland)). 29 Sep 1987. 21p. (CONF-870797—15). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012596/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

Since the original discovery in 1964 that both K/sub S/ and K/sub L/ decay into $\pi^+\pi$/sup {minus}/, which represents clear evidence for CP violation, the challenge has been to devise experiments and theoretical models that could elucidate the nature of this phenomenon and its source. A number of implications have been analysed: for example, it was pointed out in 1976 that CP violation, combined with a very small baryon instability, could have produced, in the early explosive development of the Universe, the matter-antimatter imbalance as manifested today by the measured ratio N/sub baryons//N/sub photons/ $\simeq 10^9$. These topics will be developed in this paper. 14 refs., 14 figs., 4 tabs.

45951 **(CERN-EP—87-211) Charm photoproduction and lifetimes from the NA14/2 experiment.** Filippas, A.; Fokitis, E.; Gazis, E.N.; Katsoufis, E.C.; Maltezos, A.; Papadopoulou, Th.; Rahmani, H.; Alvarez, M.P.; Calvino, F.; Crespo, J.M. (European Organization for Nuclear Research, Geneva (Switzerland)). 19 Nov 1987. 10p. (CONF-8709147—11). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013859/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

This experiment combines a silicon active target, a silicon microstrip telescope allowing precise reconstruction of the charm vertices, and a large-acceptance spectrometer where charged tracks and photons are reconstructed. Preliminary results are given on the observation of the decay of D/sup {plus}/ and D/sub s/ to {phi}π, on the transverse momentum distribution of photoproduced D mesons, and on the measurements of D^0 and Λ/sub c/ lifetimes. 7 refs., 8 figs.

45952 **(CERN-EP—87-215) Threshold measurement of the reaction {bar p}p $\rightarrow$ {bar {Lambda}}Λ at LEAR.** Barnes, P.D.; Birien, P.; Bonner, B.E.; Breunlich, W.H.; Diebold, G.; Dutty, W.; Eisenstein, R.A.; Ericsson, G.; Eyrich, W.; von Frankenberg, R. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Nov 1987. 5p. (CONF-8709160—9). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013861/JAW.

From 4. LEAR workshop; Villars-sur-Ollon, Switzerland (6 Sep 1987).

We report on new results of experiment PS185 at LEAR. In particular, the threshold measurement of the reaction {bar p}p $\rightarrow$ {bar {Lambda}}Λ} will be discussed. From the shapes of the excitation function and of the angular distributions, we conclude that there are p-wave contributions even at energies down to threshold. 8 refs., 4 figs.

45953 **(CONF-880280—2) Results from CERN experiment WA80.** Gutbrod, H.H.; Plasil, F.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Dragon, L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012530/JAW.

From International conference on physics and astrophysics of quark-gluon plasma; Bombay, India (8 Feb 1988).

As in the case of most of the experiments discussed at this conference, the primary goal of WA80 is a search for evidence that a quark-gluon plasma (QGP) has been formed, or that some similar phase transition has taken place. A number of signatures for QGP formation have been suggested, and most experiments have been designed so as to obtain data that pertain to one or more of these signatures. In the case of WA80, the primary probe for the investigation of the QGP is the measurement of photons that may be emitted from the plasma phase. An understanding of the various QGP signatures, however, requires an understanding of the background created by reaction products that do not relate directly to QGP production and thus requires a thorough understanding of the reaction mechanism governing nucleus-nucleus collisions at these extreme energies. Consequently, another important goal of WA80 is to survey nucleus-nucleus collisions at 60 and 200 GeV/nucleon and to compare the results to those obtained from proton-nucleus interactions. We have pursued this second goal by measuring forward and transverse energies, by studying the multiplicities of produced charged particles over a large range of pseudorapidity, by investigating transverse momentum spectra of neutral products, and by examining target fragmentation products. In this paper we review all of our results obtained with 60- and 200-GeV/nucleon {sup 16}O projectiles, with the exception of charged-particle multiplicity data, which are discussed in a separate presentation at this conference. We also present the first preliminary calorimeter results from {sup 32}S bombardments at 6.4 TeV. 22 refs., 13 figs., 2 tabs.

45954 (DOE/ER/03130—T15) Progress report of a research program in experimental high energy physics, January 1, 1988-December 31, 1988: Task B. Widgoff, M. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1 Jul 1988. Contract AC02-76ER03130. 47p. (COO—3130TB-265). NTIS, PC A04. Order Number DE88012763/JAW.

The group at Brown has joined a collaboration to carry out experiments in high energy physics using astrophysical sources, in the new underground laboratory being prepared at Gran Sasso. We are building a detector (LVD) which includes a volume of liquid scintillator together with a multilayered omnidirectional tracking system if high spatial and angular resolution, in order to study particle physics in a domain beyond the range of accelerators now or soon to be available. Among the physics questions we will be able to address very effectively are neutrino oscillations, discrete sources of high energy radiation including muons and neutrinos, dark matter and exotic particles, neutrinos from stellar collapse, and monopoles. The hybrid detector built by the E745 Collaboration, with the Tohoku one-meter holographic freon bubble chamber as target, had a second successful run at the Tevatron during 1987. The production of neutral strange particles by muon neutrinos at Tevatron energies has been investigated using the data from the 1985 run, and this study will be greatly enhanced by the addition of the events from the 1987 run. Other physics topics include a new method of observing an EMC-like effect in the muon neutrino data. A new experiment has been approved (E782) to study the interactions of muons from the Tevatron, using the E745 hybrid system. During the past year, analysis has continued both on the data of SLAC experiments BC72/73/75, studying the interactions in hydrogen of 20 GeV polarized photons, and on the data of our experiments concerning interactions of hadrons with protons and heavier nuclei.

45955 (FNAL-TM—1529) Antiproton production and energy density limitations in targets for the Fermilab pbar source. Azhgirey, I.L.; Mokhov, N.V. (Fermi National Accelerator Lab., Batavia, IL (USA); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Jun 1988. Contract AC02-76CH03000. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014194/JAW.

The recent measurements of the antiproton yield as well as the previous ones differ from the predictions which are the basis of the TEVATRON1 Design Report. It was found in reference that at small acceptances, where the data depends essentially only on the forward pbar production cross section, the measured yield data indicates that these cross sections were over estimated by about a factor of 3 in the case of tungsten and about 2.3 in the case of copper. To clear up the situation and to understand what one can do to maximize the luminosity of the TEVATRON Collider this work has been done. Two sides of the antiproton production problem are considered: pbar production cross sections and targeting limitations. Energy deposition density distributions in targets and particle yields are studied via Monte Carlo hadronic and electromagnetic cascade calculations. In the present work we use two independent Monte Carlo programs.

45956 (INFN/TC—87-14) Simulation of the motion of charged particles in the drift tube of the TRAP experiment. Measurement of the gravitational acceleration of the antiproton. De Angelis, A.; Scuri, F.; Waldner, F. (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702866/JAW.

The drift of a bunch of charged particles has been simulated in a scenario based on the set-up for the proposed experiment on the gravitational acceleration of antimatter. The effect of the mutual electrostatic repulsion of the particles and of the external magnetic field on the Time Of Flight distribution has been studied. 7 figs.

45957 (ITEF—52(1987)) Observation of Θ(1700) and ξ(2230) resonances in the π/sup -/p -> K/sub s//sup 0/K/sub s//sup 0/n reaction at 40 GeV/c. Bolonkin, B.V.; Bloshenko, S.K.; Vladimirskij, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702885/JAW.

The reaction π/sup -/p -> K/sub S//sup 0/K/sub S//sup 0/ was studied by incident momentum 40 GeV/c at 6-m magnetic spark spectrometer. Partial wave analysis was carried out using 6700 events of this reaction with t < 0.2 (GeV/c)/sup 2/. In D/sub 0/-wave (J/sup PC/=2/sup ++/). Three states besides well-known resonances f(1270) and f'(1520); Θ(1700) with the width 30 MeV, f''(1980) with the width 145 MeV (very likely a radial exitation of f'(1520) meson) and ξ(2230) with the width 80 MeV are found. Measured width of Θ-meson is somewhat smaller, and that of ξ-meson is somewhat higher than values known from J/psi radiative decays. In S-wave (J/sup PC/=0/sup ++/) knwon states ε'(1440) and S*(1720) are found. 25 refs.; 15 figs.

45958 (KFK—4294) Searches for supersymmetric particles with the CELLO detector at Petra. Kuester, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Physik). Feb 1988. 123p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754180/JAW.

A search was made for missing transverse momentum final states such as acoplanar lepton pairs, acoplanar jets, single electrons, and single jets in e/sup +/e/sup -/ collisions at center of mass energies between 40 and 46.78 GeV. Moreover, multihadronic final states were searched for an excess of spherical events. No unexpected signal was observed. This result is used to put mass limits on various supersymmetric particles, namely scalar electrons, scalar taus, winos, zinos, and higgsinos considering various assumptions on their decay modes. An extensive discussion is given of the consequences of various choices for the lightest supersymmetric particle and of gaugino higgsino mixing. In addition, limits are given on pair production of charged Higgses (or technipions) and on a fourth generation heavy lepton.

45959 (LA-UR—88-1866) The MEGA [Muon decays into an Electron and a GAmma ray] experiment: A search for μ → eγ. Cooper, M.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8805142—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014453/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

The MEGA experiment is designed to search for the $\mu \rightarrow e\gamma$ process with a branching ratio sensitivity of 10^{-12}. This decay violates the empirically established rule of lepton family number conservation and lies outside the Standard Model of electroweak interactions. In order for the experiment to make a factor of 500 improvement over the existing limit, a new design was adopted that employs highly modular, fast detectors and state-of-the-art electronic readout. The detectors are contained in a 15 kG solenoidal field produced by a superconducting magnet. The central region is a positron spectrometer, and the outer region is four layers of pair spectrometers. Data taking is expected to commence in 1989. 6 refs., 3 figs.

45960 (SLAC-PUB—4555) Polarization as a tool for studying particle properties. Grosse-Wiesmann, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1988. Contract AC03-76SF00515. 7p. (CONF-870821—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010680/JAW.

From SLAC summer institute on particle physics: looking beyond the Z; Stanford, CA, USA (10 Aug 1987).

The use of polarized beams in e/sup {plus}/e/sup {minus}/ collisions at the Z^0pole provides a powerful tool for the separation of the charge and spin of the produced fermions. Such a separation

is essential for many investigations of particle properties. It is shown that this technique can be used to substantially improve studies of CP violation in neutral B mesons and the charged structure of {tau} decays.

45961 **(TPC-LBL—87-13) Charmonium production in photon-photon collisions.** Aihara, H.; Alston-Garnjost, M.; Avery, R.E.; Barbaro-Galtieri, A.; Barker, A.R.; Barnett, B.A.; Bauer, D.A.; Bengtsson, H.U.; Bobbink, G.J.; Bolognese, T.S.; Bross, A.D.; Buchanan, C.D.; Buijs, A.; Caldwell, D.O.; Chao, H.Y.; Chun, S.B.; Clark, A.R.; Cowan, G.D.; Crane, D.A.; Dahl, O.I.; Daoudi, M.; Derby, K.A.; Eastman, J.J.; Eberhard, P.H.; Edberg, T.K.; Eisner, A.M.; Enomoto, R.; Erne, F.C.; Fujii, T.; Gary, J.W.; Gorn, W.; Hauptman, J.M.; Hofmann, W.; Hylen, J.; Kamae, T.; Kaye, H.S.; Kees, K.H.; Kenney, R.W.; Winston, K.; Kofler, R.R.; Lander, R.L.; Langeveld, W.G.J.; Layter, J.G.; Lin, W.T.; Linde, F.L.; Loken, S.C.; Lu, A.; Lu, X.Q.; Lynch, G.R.; Madaras, R.J.; Maeshima, K.; Magnuson, B.D.; Masek, G.E.; Mathis, L.G.; Matthews, J.A.J.; Maxfield, S.J.; Miller, E.S.; Moses, W.; McNeil, R.R.; Nygren, D.R.; Oddone, P.R.; Paar, H.P.; Park, S.K.; Pellett, D.E.; Pripstein, M.; Ronan, M.T.; Ross, R.R.; Rouse, F.R.; Schwitkis, K.A.; Sens, J.C.; Shapiro, G.; Shen, B.C.; Slater, W.E.; Smith, J.R.; Steinman, J.S.; Stephens, R.W.; Stevenson, M.L.; Stork, D.H.; Strauss, M.G.; Sullivan, M.K.; Takahashi, T.; Toutounchi, S.; van Tyen, R.; VanDalen, G.J.; Vernon, W.; Wagner, W.; Wang, E.M.; Wang, Y.X.; Wenzel, W.A.; Williams, M.C.S.; Wolf, Z.R.; Yamamoto, H.; Yellin, S.J.; Zeitlin, C.; Zhang, W.M. (Lawrence Berkeley Lab., CA (USA); California Univ., Davis (USA); California Univ., Stanford (USA). Intercampus Inst. for Research at Particle Accelerators; California Univ., Los Angeles (USA); California Univ., Riverside (USA); California Univ., San Diego (USA); California Univ., Santa Barbara (USA); Carnegie-Mellon Univ., Pittsburgh, PA (USA); Ames Lab., IA (USA); Johns Hopkins Univ., Baltimore, MD (USA); Massachusetts Univ., Amherst (USA); Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands); Tokyo Univ. (Japan)). 1987. Contract AC03-76SF00098;W-7405-ENG-82. 17p. (CONF-870632—20). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013211/JAW.

From International Europhysics conference on high energy physics; Uppsala, Sweden (25 Jun 1987).

We have searched for the two-photon production of the {eta}{sub c}, {chi}{sub 0} and {chi}{sub 2} charmonium states at the e{sup +}e{sup -} collider PEP in the channels {gamma}{gamma} {yields} K{sup +-}K{sub S}{sup 0}{pi}{sup -+}, {gamma}{gamma} {yields} K{sup +}K{sup -}{pi}{sup +}{pi}{sup -}, {gamma}{gamma} {yields} {pi}{sup +}{pi}{sup -}{pi}{sup +}{pi}{sup -} and {gamma}{gamma} {yields} K{sup +}K{sup -}K{sup +}K{sup -}. We identify four {eta}{sub c} candidates in the K{sup +}K{sup -}K{sup +}K{sup -} channel, on a negligible background; this leads to a preliminary 95% C.L. lower limit for {Gamma}{sub {gamma}{gamma}}({eta}{sup c}) of 1.6 keV. In the other channels we find no evidence for any of the three states and establish preliminary 95% C.L. upper limits {Gamma}{sub {gamma}{gamma}}({eta}{sub c}) < 15 keV, {Gamma}{sub {gamma}{gamma}}({chi}{sub 0})< 14 keV and {Gamma}{sub {gamma}{gamma}}({chi}{sub 2}) < 4.0 keV. Combining the results on the {eta}{sub c} from all channels we obtain the value {Gamma}{sub {gamma}{gamma}}({eta}{sub c}) = 4.5{sub -3.6}{sup -5.5 keV. 18 refs., 3 figs., 1 tab.

45962 **(UUIP—1161) Diffusion and trapping of muons in aluminium: New experiments and comparison with Kondo theory.** Hartmann, O.; Karlsson, E.; Waeckelgaard, E.; Waeppling, R.; Richter, D.; Hempelmann, R.; Niinikoski, T.O. (Uppsala univ. (SE). Institute of Physics; ILL, Grenoble (FR); IFK, KFA Juelich (DE); CERN, Geneva (CH)). (Uppsala Univ. (Sweden). Inst. of Physics). Mar 1987. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754507/JAW.

The diffusion and trapping of positive muons in aluminium has been studied using the method of muon spin rotation. New measurements have been performed on Al-samples doped with Mg, Si, Ga and Ge-impurities (which trap the muons), and for comparison also on an Ag-sample doped with Er. Trapping rates and trapping site information were obtained for temperatures between 0.05 K and 50 K. A global fit to these and earlier published data for trapping by other impurities (Li, Mn, Ag) and vacancies has made it possible to deduce the temperature dependence of the intrinsic diffusion in Al for the range 0.05 - 200 K and to compare it with the recently developed theory by Kondo for light interstitial diffusion in metals. In the low temperature range (0.05 - 2 K) it shows a T/sup -0.7/ dependence, followed by an approximately linear T-dependence (2 - 20 K) and an exponential (activated) behaviour at higher temperatures. The theory for the low-T diffusion, which is based on tunneling with energy dissipation through the screening electrons, describes the experimental data with reasonable parameters. For the intermediate range there are strong indications of one phonon assisted diffusion. The trapping sites close to the impurities are discused with reference to the elastic distortions and the electronic density modifications introduced by the different impurities. (with 52 refs.)

45963 **Minimum bias and mini-jets at the SSC.** Pancheri, G.; Srivastava, Y. (Physics Dept., Harvard Univ., Cambridge, MA (US)). *International Journal of Modern Physics A;* 2: No. 4, 1389-1392(Aug 1987). (CONF-8705163—).

From Madison SSC workshop: from colliders to supercolliders; Madison, WI, USA (11 May 1987).

To delineate any new physics which may arise at the SSC, it is quite obvious that one must be able to clearly separate it from the background. This is the bane of hadronic colliders. Fortunately, a study of such background is not devoid of physical interest, since it contains a wealth of information about the inelastic hadronic cross-section. The background in question is the minimum bias dσ/dE/sub T/, possibly from QCD. For large E/sub T/, perturbative QCD has been quite successful in obtaining quantitative jet cross-sections. How low in E/sub T/ can one go at the SSC? The authors experience with minimum bias and mini-jets analyses at the Cern Collider has been that jets with E/sub T/ $\geqq$ 5 GeV can be isolated. So the natural question is: would a 5 GeV jet be visible as a jet at the SSC? Even if the answer is "yes" insofar as it concerns the kinematic aspects of experimental detection and resolution, there is still the possibility that such a signal is covered up by the background provided by other low-E/sub T/ jets whose dynamical origin is somewhat different from the one which produces a typical large E/sub T/ jet. This is an important physics issue to which the authors turn to this paper.

45964 **The GGLP effect from 1959 to 1984.** Goldhaber, G. (Lawrence Berkeley Lab. and Dept. of Physics, Univ. of California, Berkeley, CA (US)). pp 115-142 of Local equilibrium in strong interaction physics (LESIP I). Scott, D.K.; Weiner, R.M. Teaneck, NJ; World Scientific Pub. Co. (1985). (CONF-8409358—).

From International course on observational and theoretical aspects of relativistic astrophysics and cosmology; Santander, Spain (3 Sep 1984).

In 1959 the author was involved in an experimental search for the rho meson at the Bevatron. This search was inspired by a paper by Frazer and Fulco, working in Berkeley at that time with Geoff Chew, who had just predicted that a pion-pion resonance with I = 1 and J = 1 should exist. The author was working on a p-barp experiment in Wilson Powell's propane Bubble chamber at 1.05 GeV/c. It was decided that the "hydron like events would be a good place to look for the rho meson. He thus calculated the invariant mass of pion pairs and realized that by comparing LIKE charged pairs with UNLIKE charged pairs they should be able to detect the rho. As the statistics were not adequate enough, he was unable to observe the rho meson in this experiment. However, he decided to also try comparing a simpler quantity: the cosine of the opening angle between a pion pair in the overall CM system. Here, he found a dramatic difference between LIKE and UNLIKE pion pairs. Thus he observed a clear deviation from phase space. The first empirical observation was thus the fact that the angular distributions for LIKE and UNLIKE charge pion pairs were distinctly different. The author expressed this result quantitatively by quoting the ratio γ of the number of pion pairs with opening angles greater than 90° to those with angles less than 90°.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 45949, 45978, 45983, 46018, 46019, 46046, 46204

45965 (BONN-HE—88-05) Some Higgs decays of pseudoscalar quarkonium. Bergstroem, L.; Rubinstein, H.R.; Poutianinen, P. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Stockholm Univ. (Sweden). Dept. of Physics). (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754306/JAW.

The decay of a heavy pseudoscalar quark-antiquark bound state into a scalar or pseudoscalar Higgs particle and two gluons or photons is considered. A striking result of our calculation is the very different invariant mass distributions of the photons or gluons in the scalar and pseudoscalar Higgs cases. The case of toponium decay into Higgs particles predicted in minimal supersymmetric models is described in some detail. Some applications for the light eta and eta' mesons are also discussed.

45966 (CERN/EP—87-158) Leptoquarks and diquarks in e$^+$e/sup {minus}/ collisions up to 2 TeV. Schaile, D.; Zerwas, P.M. (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Sep 1987. 20p. (CONF-870180—7). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012591/JAW.

From Workshop on physics at future accelerators; La Thuile, Italy (7 Jan 1987).

The production and decay of isosinglet leptoquarks and diquarks are studied in e/sup {plus}/e/sup {minus}/ collisions up to an energy of 2 TeV. Their properties and decays are adopted from a minimal superstring inspired model - but they are also shared by particles in composite models. 13 refs., 7 figs., 6 tabs.

45967 (CERN-EP—87-163) Constraints on physics beyond the Standard Model from the UA1 experiment at the CERN proton-antiproton collider. Geer, S. (European Organization for Nuclear Research, Geneva (Switzerland)). 8 Sep 1987. 14p. (CONF-870632—18). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013850/JAW.

From International Europhysics conference on high energy physics; Uppsala, Sweden (25 Jun 1987).

This paper summarizes significant limits on possible extensions of the Standard Model using data from the UA1 experiment at the CERN proton-antiproton collider. Limits are given on the existence of the top quark, fourth-generation quarks and leptons, a four-quark contact interaction, leptoquarks, heavy W and Z bosons, supersymmetric particles, and an object X decaying into W + jet or jet + jet. 14 refs., 9 figs., 1 tab.

45968 (CERN/EP—87-208) CP (non-)conservation in hyperon decays. Hamann, N. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Nov 1987. 7p. (CONF-8709160—8). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88012603/JAW.

From 4. LEAR workshop; Villars-sur-Ollon, Switzerland (6 Sep 1987).

The CP violation observables in hyperon non-leptonic decays and their values predicted by theory are reviewed. A first experimental result from {bar p}p {yields} {bar {Lambda}{Lambda}} experiments using external or internal targets at LEAR, as well as those with {bar p}p} {yields} {bar {Lambda}{Lambda}} and {bar p}p {yields} {bar {Xi}{Xi}} measurements in collider experiments at Super-LEAR, are outlined. 17 refs., 2 figs.

45969 (CERN-EP—87-214) Precision measurements of standard electroweak model parameters in LEP [Large Electron-Positron storage ring]. Blondel, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Nov 1987. 25p. (CONF-8705241—3). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013860/JAW.

From 10. Warsaw symposium on elementary particle physics; Kazimierz, Poland (25 May 1987).

A combined knowledge of the Z mass, the W mass, and the fermion couplings to the Z will be obtained in the Large Electron-Positron storage ring (LEP) with unprecedented accuracy, providing information about physics beyond our energy scale. The question of the feasibility in LEP of longitudinally polarized beams, which are essential for accurate measurements of the couplings at the Z, is briefly considered. 37 refs., 13 figs., 7 tabs.

45970 (CONF-880560—3) The nuclear dependence of parton distributions. Close F.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012940/JAW.

From Topical conference on nuclear quantum chromodynamics; Argonne, IL, USA (19 May 1988).

I review the emerging information on the way quark, antiquark, and gluon distributions are modified in nuclei relative to free nucleons. I place particular emphasis on Drell--Yan and {psi} production on nuclei and caution against premature use of these as signals for quagma in heavy-ion collisions. 17 refs.; 5 figs.

45971 (GSI—88-19-Prepr.) Vacuum polarization in a strong external field. Soff, G.; Mohr, P.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics; National Bureau of Standards, Washington, DC (USA)). Mar 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754155/JAW.

Vacuum polarization in the field of a high-Z finite size nucleus is examined, and the polarization charge density in coordinate space of order $\alpha(Z\alpha)^n$ with $n \geq 3$ is calculated. Energy level shifts of K- and L-shell electrons in hydrogen-like systems are given.

45972 (INIS-mf—11771) Quantum electrodynamics in one space and one time dimension. Eller, T. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1987. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754330/JAW.

We present a non-perturbative solution of the massive Schwinger model in the formalism of the discrete light-cone quantization. By means of this method in the light-cone gauge the eigenvalues and eigenfunctions of the Lorentz-invariant mass for all combinations of the Lagrangian fermion mass and the coupling constant can be calculated. Different initial conditions lead to the massive and massless fermion representation in which the constants of motion are described as Fock-space operators. Already small values of the harmonic resolution yield a qualitatively correct picture of the mass eigenvalues of bound states. It is shown that for finite mass the massive representation converges faster to the continuum limit. The massless fermion representation has the advantage that it can reproduce exactly the Schwinger model. For large coupling constant in which the QED/sub 2/ goes over to a theory of free bosons we calculate the mass eigenvalues in a boson formulation of the theory. The two-particle approximation of the fermion representations yield a good approximation of the lowest states. In this approximation we can calculate masses and eigenfunctions directly in the continuum limit. Furthermore the two-particle approximation yields the number of the bound states. As examples we calculate from the wave functions of the bound states the structure functions. We are able to determine separately the contributions of the valence and sea quarks of the massive Schwinger model. (orig./HSI).

45973 (LA-UR—88-1789) Probing nuclear correlations with pion-nucleus double charge exchange. Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 21p. (CONF-880639—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014468/JAW.

From International conference on contemporary topics in nuclear structure physics; Cocoyoc, Mexico (9 Jun 1988).

In this paper we have calculated the lowest order pion double charge reaction mechanism using shell model wavefunctions of medium weight nuclei. We have the sequential reaction mecha-

nism in which the pion undergoes two single-charge exchange scatterings on the valence neutrons. The distortion of the incoming, intermediate, and outgoing pion are included. The closure approximation is made for the intermediate states with an average excitation energy used in the pion propagator. The double-charge exchange is assumed to take place on the valence nucleons which are assumed to be in one spherical shell model orbital. 34 refs., 5 figs., 3 tabs.

45074 **(PITHA—88/11) Improved parton showers in ep interactions.** Bengtsson, M. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Theoretische Physik A und Inst. fuer Theoretische Physik). (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Theoretische Physik und Inst. fuer Theoretische Physik). May 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754355/JAW.

A scheme for including the first order matrix element in ep parton showers is presented. This is an important improvement since it applies to hard emission where the leading-log approximation is less reliable. The contributions from the initial and final state showers are treated on an equal footing, solving the potential problem of double counting of emission. Kinematical constraints, relating the dynamics of the two separate showers, are also solved in this context. The choice of splitting variable in initial state showers is furthermore discussed.

45075 **The inelasticity distribution in high energy hadronic collisions.** Plumer, M.; Weiner, R.M.; Friedlander, E.M.; Fowler, G.N. (Univ. of Marburg (DE)). pp 185-203 of Local equilibrium in strong interaction physics (LESIP I). Scott, D.K.; Weiner, R.M. Teaneck, NJ; World Scientific Pub. Co. (1985). (CONF-8409358—).

From International course on observational and theoretical aspects of relativistic astrophysics and cosmology; Santander, Spain (3 Sep 1984).

For any attempt towards an understanding of multiparticle production in high energy hadronic collision processes, it is essential to take into account the leading particle effect which has been investigated in great detail.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 45950

45076 **(CERN-EP—87-155) Prospects of supersymmetry searches in very high energy e^+e^- collisions.** Dionisi, C.; Dittmar, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 27 Aug 1987. 17p. (CONF-870180—6). NTIS (US Sales Only), PC A03. Order Number DE88012590/JAW.

From Workshop on physics at future accelerators; La Thuile, Italy (7 Jan 1987).

The production and detection of supersymmetric particles (sparticles) at a hypothetical 1 TeV + 1 TeV e^+e^- CERN Linear Collider (CLIC) have been investigated. The detection of almost the full spectrum of the proposed new sparticles up to masses of about 90% of the beam energy (900 GeV) would be possible if a luminosity of about 12.5 fb^{-1} {times} s(s in TeV^2), or 50 fb^{-1} at $\sqrt{s}$ = 2 TeV can be achieved. Besides the possibility of detection, we show, as an example, how the reaction $e^+e^- \rightarrow$ {tilde {mu}}{tilde {mu}} can be further analyzed to determine the mass and the spin of such new sparticles. From our studies we conclude that an e^+e^- collider with the above characteristics would be the ideal machine with which to study SUSY phenomena up to the TeV region. Moreover, we find that such a machine should be built with a flexible centre-of-mass energy to measure the physical properties of the new phenomena with high precision. 7 refs., 16 figs.

45077 (INIS-mf—11260, pp 36) **Unstable state in the B=2 sector of SU(3)/sub F/ SKYRME model.** Gat, G.; Dothan, Y. (Tel Aviv Univ. (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

45078 **(NEI-NO—49) Chiral symmetry and finite temperature effects in quantum theories.** Larsen, Aa. (Oslo Univ. (Norway). Fysisk Inst.). 1987. 115p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754482/JAW.

A computer simulation of the harmonic oscillator at finite temperature has been carried out, using the Monte Carlo Metropolis algorithm. Accurate results for the energy and fluctuations have been obtained, with special attention to the manifestation of the temperature effects. Varying the degree of symmetry breaking, the finite temperature behaviour of the asymmetric linear model in a linearized mean field approximation has been studied. In a study of the effects of chiral symmetry on baryon mass splittings, reasonable agreement with experiment has been obtained in a non-relativistic harmonic oscillator model. 102 refs.

45079 **(SLAC-PUB—4598) Quark flavor mixing, CP violation, and all that.** Gilman, F.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Apr 1988. Contract AC03-76SF00515. 18p. (CONF-880288—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012729/JAW.

From Les Recontres de Physique; La Thuile, Italy (28 Feb 1988).

We review the present state of knowledge of the mixing of quark flavors under weak interactions and the associated explanation of CP violation inherent in the single nontrivial phase present in the three-generation mixing matrix. In this context we present the phenomenological basis for the increasing possibility that large CP violation asymmetries can be experimentally observed in the B meson system. 39 refs., 11 figs.,

6454 Field Theory

45080 **(CONF-880189—1) Spin physics: A challenge to the generally accepted picture of QCD.** Preparata, G. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 1988. 17p. NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012569/JAW.

From Adratico research conference on spin and polarization dynamics in nuclear and particle physics; Trieste, Italy (1 Jan 1988).

This paper discusses the use of spin theory to describe physical phenomenon that are not well defined by other theories, like perturbation theory. Some topics discussed are: Hyperon polarization in hadron-hadron collisions; asymmetry in the inclusive π^0 production on a polarized target; spin-spin correlations in large angle pp scattering; {rho} alignment in large angle {rho} production; angular distribution of high mass, high p/sub T/ μ-pairs; spin-dependent structure functions. (LSP)

45081 **(DOE/ER/03130—T18) Progress report for a research program in computational physics: Progress report, January 1, 1988-December 31, 1988.** Guralnik, G.S. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1988. Contract AC02-76ER03130. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012765/JAW.

The project of this progress report are all ultimately concerned with various aspects of numerical simulations of lattice gauge theories. These aspects include algorithms, machines, theoretical studies and actual simulations. We made progress in four general areas: studies of new algorithms, determination of the SU(3) β-function, studies of the finite temperature QCD phase transition in the presence of fermions, and the calculation of hadronic matrix elements. We will describe each of these in turn. 7 refs.

45082 **(INFN-LNF—87-97(PT)) QCD at finite baryon density.** Vladikas, A. (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 7p. (CONF-8709225—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703203/JAW.

From International symposium on field theory on the lattice; Seillac, France (28 Sep 1987).

Direct attempts to measure the chiral condensate in QCD with dynamical fermions and non-zero chemical potential fail to predict the chiral symmetry restoretion transition point. An alternative method is proposed and some early results is presented.

45983 **(INIS-mf—11786) Quantisation of abelian gauge field in the temporal-like gauges based on stochastic mechanics.** Lim, S.C. (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)). 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754339/JAW.

BiBoS.; no. 303/88.

Stochastic mechanics can be applied consistently to quantise abelian gauge field in the temporal-like gauges such as the flow gauges, static gauges and the fully fixed temporal gauge.

65 PHYSICS II

45984 **(INIS-mf—11260) Israel Physical Society annual meeting 1988. Program and abstracts.** (Israel Physical Society, Jerusalem; Technion-Israel Inst. of Tech., Haifa). 1988. vp. (CONF-8803131—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW.

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc.; Vol. 34.

The papers in these proceedings were indexed and abstracted separately.

6510 Nuclear Physics

45985 **(BNL-NCS—40911) Reports to the DOE Nuclear Data Committee.** (Brookhaven National Lab., Upton, NY (USA)). May 1988. Contract AC02-76CH00016. 202p. (DOE/NDC—47/U; NEANDC(US)—226/U; INDC(USA)—101/L). NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88013006/JAW.

The report in this document were submitted to the Department of Energy, Nuclear Data Committee (DOE-NDC) in April 1988. The reporting laboratories are those with a substantial program for the measurement of neutron and nuclear cross sections of relevance to the US applied nuclear energy program. Appropriate subjects are microscopic neutron cross sections relevant to the nuclear energy program, including shielding. Inverse reactions where pertinent are included; charged-particle cross sections where relevant to developing and testing nuclear models; gamma ray production, radioactive decay, and theoretical developments in nuclear structure which are applicable to nuclear energy programs; and proton and alpha-particle cross sections, at energies of up to 1 GeV, which are of interest to the space program.

45986 **(BNL-NCS—41379) Neutron cross sections: Book of curves.** McLane, V.; Dunford, C.L.; Rose, P.F. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-880546—24). NTIS, PC A02. Order Number DE88012523/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

Neuton Cross Sections: Book of Curves represents the fourth edition of what was previously known as BNL-325, Neutron Cross Sections, Volume 2, CURVES. Data is presented only for (i.e., intergrated) reaction cross sections (and related fission parameters) as a function of incident-neutron energy for the energy range 0.01 eV to 200 MeV. For the first time, isometric state production cross sections have been included. 11 refs., 4 figs.

45987 **(CERN-EP—87-188) Hard hadronic interactions and structure functions.** Sloan, T. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 Oct 1987. 27p. (CONF-870632—19). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013843/JAW.

From International Europhysics conference on high energy physics; Uppsala, Sweden (25 Jun 1987).

In this paper the following topics are reviewed: The structure function measurements in deep inelastic scattering; tests of QCD and measurements of the strong coupling constant α_s; the structure of the nucleon; and nuclear effects in deep inelastic scattering. 75 refs.

45988 **(CONF-880546—25) Examination of various roles for covariance matrices in the development, evaluation, and application of nuclear data.** Smith, D.L. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011953/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The last decade has been a period of rapid development in the implementation of covariance-matrix methodology in nuclear data research. This paper offers some perspective on the progress which has been made, on some of the unresolved problems, and on the potential yet to be realized. These discussions address a variety of issues related to the development of nuclear data. Topics examined are: the importance of designing and conducting experiments so that error information is conveniently generated; the procedures for identifying error sources and quantifying their magnitudes and correlations; the combination of errors; the importance of consistent and well-characterized measurement standards; the role of covariances in data parameterization (fitting); the estimation of covariances for values calculated from mathematical models; the identification of abnormalities in covariance matrices and the analysis of their consequences; the problems encountered in representing covariance information in evaluated files; the role of covariances in the weighting of diverse data sets; the comparison of various evaluations; the influence of primary-data covariance in the analysis of covariances for derived quantities (sensitivity); and the role of covariances in the merging of the diverse nuclear data information. 226 refs., 2 tabs.

45989 **(INIS-GB—148) Nuclear physics annual report 1987.** (Manchester Univ. (UK). Schuster Lab.). 1988. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754286/JAW.

The paper presents the annual report of the Schuster Laboratory, Manchester University Nuclear Physics Group, United Kingdom, 1986-7. Much of the work has been carried out at the Daresbury Nuclear Structure Facility, often in collaboration with other U.K. groups and with foreign participation. The report contains the work on: studies of light nuclei, spectroscopy of medium mass nuclei, low and high spin spectroscopy of nuclei with $A \geqq 100$, and the fission process. Technical developments carried out at the Laboratory are also described. (U.K.).

45990 **(INIS-SU—40/A) JINR rapid communications. Collection.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 61p. (RU;EN). (N—4(24)-87). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW.

Separate abstracts have been prepared for the papers in this collection.

45991 **(JINR—R-1-87-348) Study on the two-particle correlations in inelastic interactions of neon-22 nuclei at P/sub 0/=4.1 GeV/c per nucleon with emulsion nuclei.** Krasnov, S.A.; Tolstov, K.D.; Shabratova, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702922/JAW.

Submitted to the journal Sov. J. Nucl. Phys.

Two-particle correlations between the space and azimuthal angles of charged particle emission out inelastic interactions of relativistic neon-22 nuclei with emulsion have been investigated. The absence of any correlations between particle emission polar angles does not contradict the independent emission hypothesis for all particles. The correlation effects observed in the transverse plane of the interaction are discussed, in particular the tendency of the emission of different type particles in opposite directions in the azimuthal plane and also the tendency of increasing the particle emission asymmetry in this plane with increasing the degree of collision centrality. 14 refs.; 8 figs.; 2 tabs.

45992 **(JINR—R-1-87-423) Inclusive characteristics of π/sup -/ - mesons produced in pC and pTa interactions at proton momentum of 10 GeV/c.** Armutlijski, D.D.; Grishin, V.G.; Ivanovskaya, I.A.; Kladnitskaya, E.N.; Akhababyan, N.O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702923/JAW.

Submitted to the journal Sov. J. Nucl. Phys.

New data on inelastic pC and pTa interactions at an incident proton momentum of 10 GeV/c have been obtained in the inclusive approach for 4π-geometry. The distributions of secondary π/sup -/-meson over different with analogous ones for an incident proton momentum of 4.2 GeV/c as well as with predictions of a Dubna version of the cascade - evaporation model. The model is shown to describe well the π/sup -/-meson experimental distributions over momentum up to - 6 GeV/c, over transverse momentum squared up to - 1 (GeV/c)/sup 2/ as well as over rapidity in the central region. At the same time the model differs substantially from the experiment in the region of projectile and target fragmentation and also in the multiplicity distribution of π/sup -/-mesons. 14 refs.; 7 figs.; 6 tabs.

45993 **(JINR—R-3-87-393) Differential elastic scattering cross sections of KeV neutrons on medium and heavy nuclei.** Kuznetsova, L.V.; Popov, A.B.; Samosvat, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702930/JAW.

The measurements of angular distributions of neutrons scattered on /sup 92/Mo, /sup 94/Mo, Dy, Er, W and /sup 238/U samples are carried out with the IBR-30 reactor at 25 ns/m resolution in the energy region upto 440 keV. The parameters of differential elastic scattering cross sections are obtained. The contribution of inelastically scattered neutrons has been taken into account in the analysis of experimental data for Dy, Er, W and /sup 238/U by the Hauser-Feshbach formula with Moldauer correction which gave a possibility to express the inelastic scattering cross sections σ/sub in/ through the neutron strength functions. The elastic scattering cross sections σ/sub S/(E), anisotropy parameters (laboratory system) ω/sub 1/(E), ω/sub 2/(E) and the calculated meaning of σ/sub in/(E) for heavy nuclei are given in tables.

45994 **(KFK—4405) Annual report on nuclear physics activities. July 1, 1986 - June 30, 1987.** Heeringa, W.; Voss, F. (eds.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Feb 1988. 180p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754185/JAW.

This report surveys the activities in basic research from July 1, 1986 to June 30, 1987 at the Institute for Nuclear Physics (IK) of the Nuclear Research Center Karlsruhe. The research program of this institute comprises laser spectroscopy, nuclear reactions with light ions, neutron physics, neutrino physics and high energy physics, as well as detector technology.

6511 Experimental Techniques

45995 **(CERN/EP—87-180) Mass measurements of short-lived isotopes in a Penning trap.** Kern, F.; Egelhof, P.; Hilberath, T.; Kalinowsky, H.; Kluge, H.J.; Kunz, K.; Schweikhard, L.; Stolzenberg, H.; Moore, R.B.; Audi, G. (European Organization for Nuclear Research, Geneva (Switzerland)). 30 Sep 1987. 9p. (CONF-870970—15). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88012598/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

A mass spectrometer has been set up at the on-line isotope separator ISOLDE at CERN, Geneva. Mass-separated radioactive ions are stored in a Penning trap. Their mass is determined by a measurement of the cyclotron frequency in the magnetic field of a superconducting magnet. A resolving power of up to 300.000 and a precision of some 10 keV were determined in a case of mass measurements of neutron-deficient Rb and Cs isotopes. The resonance of the isobars ^{88}Sr and ^{88}Rb were clearly resolved and evidence was obtained for an isomer in ^{123}Cs. 16 refs., 5 figs.

45996 **(CERN-EP—87-203) New techniques and results of collinear laser spectroscopy: Radon, xenon and holmium.** Neugart, R.; Arnold, E.; Borchers, W.; Neu, W.; Ulm, G.; Wendt, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Nov 1987. 10p. (CONF-870970—18). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013856/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

The moments and radii of extremely neutron-rich radon and xenon isotopes have been investigated by collinear possible owing to the breakthrough in sensitivity achieved by the detection of optical pumping via state-selective collisional ionization. The results are discussed within the systematics of nuclear shapes around N = 136 and N = 90. In the latter context measurements on the neutron-deficient holmium isotopes give new details about the development of nuclear deformation. 19 refs., 6 figs., 2 tabs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

45997 **(CERN-EP—87-191) Collision experiments with antiprotons.** Uggerhoej, E. (European Organization for Nuclear Research, Geneva (Switzerland)). 6 Oct 1987. 11p. (CONF-8709135—10). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013834/JAW.

From 14. international conference on X-ray and inner-shell processes; Paris, France (14 Sep 1987).

From the upgraded CERN antiproton ({bar p}) "factory" high intensity and low emittance {bar p}-beams in the keV-MeV region will be available for detailed atomic collision experiments. The very first investigations of {bar p} collisions in He, Ne, and Ar gases gave the most surprising results: The double ionization cross section for {bar p} on He is up to twice as high as that for protons. Similar effects are found in Ne and Ar. The x-rays emitted after the {bar p} capture in atoms offers very interesting possibilities within atomic, nuclear and particle physics. Many new collision experiments are already in preparation. 15 refs., 8 figs.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

45998 **(Juel-Spez—429) Mass- and energy-dependence of (π/sup +/,π/sup -/) double isobaric analog transitions at low energies.** Anderl, T. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY; Bonn Univ. (Germany, F.R.)). Jan 1988. 114p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754179/JAW.

Transitions to double isobaric analog states (DIAT) have been measured in the double charge exchange (DCX) reaction (π/sup +/,π/sup -/) for the nuclei /sup 26/Mg, /sup 56/Fe at Tsub(π+) = 49 MeV and for /sup 18/O at Tsub(π+) = 24 MeV, 33 MeV, 49 MeV, 64 MeV and 79 MeV for several angles. The experiments have been performed at the pion channels M13 and M11 of TRIUMF using the low energy pion spectrometer QQD. The forward angle cross sections for /sup 18/O can be understood in a quark model as well as in conventional models where the reaction is mainly proceeding through intermediate deltas or low lying excited states of the intermediate nucleus. The angular distribution of /sup 26/ Mg at 49 MeV is found to be almost identical to those of /sup 14/C and /sup 18/O while the cross section remarkedly drops for /sup 56/Fe. The forward angle excitation function of /sup 18/O exhibits a maximum at around 35 MeV. The present results are compared to theoretical predictions. Two approaches for a unified study of SCX and DCX at energies ranging from 20 MeV up to 300 MeV are presented. The first is carried out in a mean free path model for investigations of geometry effects in the reaction. For the second, the optical model code PIESDEX is employed. Both studies indicate that the observed mass dependence for DCX at 50 MeV can be explained partly by geometry considerations and partly by details in the nuclear matter distributions of core neutrons and valence neutrons. Furthermore, the optical model investigation reveals the need of shifting the free πN-SCX amplitude down by

30 MeV in order to achieve good agreement with experimental data.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

45999 **(JINR—E-1-87-547) Fragmentation of /sup 22/Ne in emulsion at 4.1 A GeV/c.** El-Naghy, A.; Krasnov, S.A.; Tolstov, K.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702904/JAW.

Submitted to the J. Phys., G.

Charge distributions of projectile fragments produced in the interactions of /sup 22/Ne beams with emulsion at 4.1 A GeV/c have been studied. Correlations between projectile and target fragments and among projectile fragments are presented. The change of charge yield distribution with the violence of the collision has been shown. The present analysis contradicts theoretical calculations describing the inclusive charge yield distribution of fragments by a single process. 26 refs.; 6 figs.; 7 tabs.

46000 **(NEANDC—222-U, pp 261-266) Neutron scattering studies and optical model calculations in the 20 MeV region.** Olsson, N.; Ramstrom, E.; Trostell, B.; Holmqvist, B. (Studsvik Science Research Lab., Nykoeping (SE)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Differential cross sections for elastic scattering of 21.6 MeV neutrons have been measured for 13 elements from Mg to Bi with an energy resolution of 0.5 MeV. The measured cross sections cover the angular range from 10/sup 0/ to 160/sup O/. The data have been analysed in terms of a conventional spherical optical model potential with and without a volume absorption term. Furthermore parametrizations of geometry and potential depths for cross section calculations are presented. Volume integrals for the real and imaginary potential parts have been calculated with the best fit parameters. The values of the integrals have been compared with results obtained from microscopic calculations according to Jeukenne, Lejeune, and Mahaux. The microscopic volume integrals agree well with those derived from the phenomenological potential.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

46001 **(NEANDC—222-U, pp 271-278) Spin-orbit interaction for neutron-nucleus scattering.** Walter, R.L.; Delaroche, J.P. (Duke Univ., Durham, NC (US). Dept. of Physics; Triangle Universities Nuclear Lab., Durham, NC (US); CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

A large body of analyzing power data for the scattering of 10-17 MeV polarized neutrons from a range of nuclei is becoming available from experiments at TUNL. The data have been employed along with differential and total cross-section data in optical model analysises to provide information about the nature of the nucleon-nucleus optical potential and about nuclear structure details. These calculations, both for spherical and deformed optical potentials, are leading to a better determination of the spin-orbit term of the optical potential. The present paper gives an overview of the results of our findings regarding the spin-orbit interaction.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

46002 **(CERN-EP—87-204) Nuclear ground state properties of strontium isotopes (78 {le} A {le} 100) by laser spectroscopy.** Buchinger, F.; Ramsay, E.B.; Silverans, R.E.; Lievens, P.; Arnold, E.; Neu, W.; Neugart, R.; Wendt, K.; Berdichevsky, D.; Fleming, R. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Nov 1987. 4p. (CONF-870970—17). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013857/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

We report on the measurements of nuclear ground state spins, moments and change in mean square charge radii in a series of strontium isotopes between A = 78 and A = 100 by collinear fast-beam laser spectroscopy. The experiment was carried out online at the ISOLDE mass separator at CERN using the traditional photon counting as well as a new particle detection method of fast beam spectroscopy. The results are presented and discussed in the light of the rapid change of nuclear shape within the investigated isotopic series. 19 refs., 2 figs., 2 tabs.

46003 **(DOE/ER/40223—T1) Theoretical and experimental cross sections for neutron reactions on ^{64}Zinc.** Rutherford, D.A. (New Mexico Univ., Albuquerque (USA)). 1987. Contract FG04-85ER40223. 100p. NTIS, PC A06. Order Number TI88011891/JAW.

Accurate measurements of the ^{64}Zn (n,2n) ^{64}Cu and ^{64}Zn (n,p) ^{64}Zn cross sections at 14.8 MeV have been made using a Texas Nuclear Neutron Generator and the activation technique. A NaI(T1) spectrometer (using two 6" x 6" NaI detectors/crystals) was used to measure the gamma radiation emitted in coincidence from the positron-emitting decay products. The measurements were made relative to ^{65}Cu (n,2n) {64}Cu and ^{63}Cu (n,2n) ^{62}Cu cross sections, which have similar half-lives, radiation emission, and were previously measured to high accuracy (2 percent). The value obtained for the (n,2n) measurement was 199 {+-} 6 millibarns, and a value of 176 {+-} 4.5 millibarns was obtained for the (n,p) measurement. In concert, a theoretical analysis of neutron induced reactions on {64}Zn was performed at Los Alamos National Laboratory using the Hauser-Feshbach statistical theory in the GNASH code over an energy range of 100 keV to 20 MeV. Calculations included width fluctuation corrections, direct reaction contributions, and preequilibrium corrections above 6 MeV. Neutron optical model potentials were determined for zinc. The theoretical values agree with the new 14.8 MeV measurements approximately within experimental error, with calculations of 201 millibarns for the (n,2n) cross section and 170 millibarns for the (n,p) cross section. Results from the analysis will be made available in National Evaluated Nuclear Data Format (ENDF/B) for fusion energy applications. 50 refs., 34 figs., 10 tabs.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

46004 **(BNL—41329) Fast first-forbidden transitions and subshell closures in the region of ^{96}Zr.** Mach, H.; Warburton, E.K.; Gill, R.L.; Casten, R.F.; Wolf, A.; Berant, Z.; Winger, J.A.; Sistemich, K.; Molnar, G.; Yates, S.W. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-8804119—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012519/JAW.

From International workshop on nuclear structure of the zirconium region; Bad Honnef, F.R. Germany (24 Apr 1988).

The low-spin β-decay of /sup 96,98/Y has been reinvestigated to obtain detailed informatin on the fast first-forbidden transitions to the ground states of /sup 96,98/Zr. A considerably more detailed decay scheme of ^{96}Y confirms the general features of a previous study. The spin of the ground state of ^{96}Y has been measured to be 0/sup {minus}/ from $\gamma\gamma(\Theta)$ angular correlations in ^{96}Sr $\rightarrow$ ^{96}Zr decay and from Q/sub β/ measurements by β–γ coincidences in the decay of ^{96}Y $\rightarrow$ ^{96}Zr. From β-decay data on $^{96-100}$Y

nuclei, mixing of the "spherical" and "collective" 0{plus} states is deduced, and the strength of the mixing matrix elements is found to vary greatly across the Zr nuclei. 20 refs., 1 fig., 1 tab.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

46005 **(CONF-8708202—10) Charged particle spectra in ^{16}O induced nuclear collisions at the CERN SPS.** Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Dragon, L.; Ferguson, R.L.; Franz, A. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. Springer-Verlag, Heidelberger P1.3 D-1000 Berlin 33, Federal Republic of Germany. Order Number TI88011048/JAW.

From Quark matter '87: 6th international conference on ultra-relativistic nucleus-nucleus collisions; Schloss Nordkirchen, F.R. Germany (24 Aug 1987).

Charged particle multiplicity distributions and pseudo-rapidity density distributions from ^{16}O induced nuclear collisions at 200 and 60 A GeV are presented. The data were taken using a minimum-bias trigger, with the WA 80 set-up at the CERN SPS. In this presentation we focus on how the yield of charged particles depends on the projectile energy, the mass number of the target nucleus and the energy measured in a uranium-plastic sampling calorimeter covering angles close to zero degrees. The data are compared to simulations from the event generator FRITIOF. 12 refs., 8 figs.

46006 **(CONF-8806117—6) Extended emission sources observed via two-proton correlations.** Awes, T.C.; Ferguson, R.L.; Obenshain, F.E.; Plasil, F.; Young, G.R.; Pratt, S.; Chen, Z.; Gelbke, C.K.; Lynch, W.G.; Pochodzalla, J. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics; National Superconducting Cyclotron Lab., East Lansing, MI (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012481/JAW.

From 3. international conference on nucleus nucleus collisions; Saint-Malo, France (6 Jun 1988).

Two-proton correlations were measured as a function of the total energy and relative momentum of the proton. The correlation is analyzed for different orientations of the relative momentum, which allows information on the size and lifetime of the emission source to be extracted. The most energetic particles are emitted from a short- lived source of compound nucleus dimensions while the lower energy protons appear to be emitted from a source considerably larger than the compound nucleus. 9 refs., 3 figs.

46007 (INIS-mf—11260, pp 37) **Absolute cross sections for ground state (γ,n) transitions.** Birenbaum, Y.; Berant, Z.; Kahane, S.; Moreh, R.; Wolf, A. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev (Israel). Dept of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

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6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

46008 **(BNL-NCS—41380) Prompt neutron emission multiplicity distributions and average values, {bar char}ν, at 2200 meter per second for the fissile nuclides.** Holden, N.E.; Zucker, M.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-880546—26). NTIS, PC A02. Order Number DE88012522/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The prompt neutron emission multiplicity distribution, P/sub nu/ is of interest for methods of self-calibration and for auto-correlation to assay fissionable material for nuclear safeguards. {bar char}ν, the average value of P/sub nu/, is of interest at neutron thermal energies since it is used as a normalizing point for energy dependent values of {bar char}ν. Values of P/sub nu/ and {bar char}ν have been determined at the standard neutron energy of 0.0253 ev for the neutron induced fission of the four fissile nuclides, /sup 233,235/U, and /sup 239,241/Pu. Revised {bar char}ν values have been obtained by re-evaluating {bar char}ν experiments measured at 2200 meter/second relative to the {bar char}ν from the spontaneous fission of ^{252}Cf. These revised values of {bar char}ν been used to renormalize the measured P/sub nu/ values. The revised values of {bar char}ν are all about 1/4% to 1/2% smaller than the corresponding values of ENDF/B-V. 25 refs., 4 tabs.

46009 **(CONF-880601—37) Generation of lumped fission product cross sections for high burnup, highly enriched uranium fuel.** Primm, R.T. III; Greene, N.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012495/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

The first set of reactor design calculations for the reactor design considered here was performed with a depletion methodology developed for converter reactor studies. These analyses showed that the ANS reactor would have a cycle length of 14 days when operated at a power level of 270 MW. Since both the cycle length and the discharge fuel burnup (209,000 MWD/MT) are very different from any of the reactors for which the depletion methodology was developed, a new study of the depletion process was initiated. Since the expected cycle length and fuel loading (18.1 kg ^{235}U) were known, input for an ORIGEN calculation could be prepared. For the work described here, cross section updates for the actinides and major fission products were prepared with data from an ENDF/B-V-derived library. The NITAWL-S and XSDRNPM-S codes were used to perform this update. The XSDRNPM model was a one-dimensional, buckled, cylindrical representation of the reactor. Fission yield values were derived from ENDF/B-IV data as contained in the ORIGEN Pressurized Water Reactor Library. 9 refs., 2 figs.

46010 **(JINR—D-7-87-392) Experiments performed to synthesize element 110.** Oganesyan, Yu.Ts.; Lobanov, Yu.V.; Hussonnois, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702902/JAW.

Submitted to the Organizing Comittee on International School on physics, 23 Jun - 3 Jul 1987, Varena, Italy.

The formation of some spontaneously fissioning nuclei with a half-life of about 10 ms and a production cross section of about 10/sup -35/ cm/sup 2/ has been detected near the Coulomb barrier in the /sup 235,236/U+/sup 40/Ar reaction. The dependence of the production cross section on /sup 40/Ae energy for this activity, its recoil energy and angular distribution are close to those expected for products of the complete-fusion reaction leading to compound nucleus formation. On the basis of an analysis of all available experimental data it is concluded that the activity observed is most likely to be due to the decay of the nucleus with atomic number 110. The half-life of the new activity is compared with the values calculated using various theoretical models. 26 refs.; 14 figs.; 3 tabs.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 44843, 45987

46011 **(BNL—41344) Subshell effects in the A = 100 region.** Mach, H. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. (CONF-8804154—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012894/JAW.

From 23. school on physics; Zakopane, Poland (16 Apr 1988).

This paper discusses the unusual nuclear features of nuclei in the A = 100 region resulting from subshell effects. Two of these features are a rapid onset of deformation at N = 60 and the exist-

ence of an almost doubly-magic nucleus of ^{96}Zr characterized by an almost complete closure of the d/sub 5/2/ neutron and p/sub 1/2/ proton orbits. 9 refs., 1 fig. (LSP)

46012 **(GSI—88-09) Microscopic and macroscopic transport theory for the description of relativistic heavy ion collisions - studies of the properties of highly compressed hot nuclear matter.** Rosenhauer, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.)). Mar 1988. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754154/JAW.

Two fundamentally different reaction models are introduced to investigate the properties of hot and dense nuclear matter created in relativistic heavy ion collisions. Based on relativistic kinetic theory, a set of covariant hydrodynamic equations of motion are derived for a multicomponent system. The macroscopic three-fluid approach is able to incorporate non-equilibrium effects into a hydrodynamical description. Hence, collective flow phenomena as well as partial transparency effects are taken into account. The three-fluid transport approach contains the former one- and two-fluid hydrodynamical models as limiting cases. The Quantum Molecular Dynamics approach (QMD) solves a microscopic transport equation. The N-body phase space dynamics of the QMD can be applied to describe the non-equilibrium processes and keeps track of particle correlations. Therefore it can be used to investigate the initial thermalization process up to the final fragmentation stage in heavy ion reactions. Complete stopping of the incoming matter is forecast in central collisions of heavy systems (Au + Au) at BEVALAC energies. This is achieved by a very large number of N-N collisions. This prediction is confirmed by experimental data. When going form intermediate to large impact parameters nonthermalized momentum distributions are observed due to the increasing number of projectile and target spectators. The stopping power does not depend much on the mean field, but is highly sensitive to the scattering cross section: Pauli-reduced cross sections result in a significant increase of transparency, which can be measured via the rapidity distribution dN/dy. In order to deduce the nuclear equation of state at high densities and temperatures from experimental data, the dependence of different particle production rates and of collective flow variables on the underlying interaction has been examined. (orig./HSI).

46013 **(GSI—88-24-Prepr.) Lepton-pair production by bremsstrahlung in central relativistic heavy ion collisions.** Lippert, T.; Becker, U.; Gruen, N.; Scheid, W.; Soff, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Giessen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Mar 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754159/JAW.

We study the production of lepton-pairs by classical bremsstrahlung in central relativistic heavy-ion collisions. For the stopping of the nuclei we assume a simple model of point charges and a deceleration time. Pair creation probabilities are calculated in first order perturbation theory.

46014 **(GSI—88-25(prepr.)) Sum rule limitations of kinetic particle-production models.** Knoll, J.; Guet, C. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. des Sciences Nucleaires; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Apr 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754312/JAW.

Photoproduction and absorption sum rules generalized to systems at finite temperature provide a stringent check on the validity of kinetic models for the production of hard photons in intermediate energy nuclear collisions. We inspect such models for the case of nuclear matter at finite temperature employed in a kinetic regime which copes those encountered in energetic nuclear collisions, and find photon production rates which significantly exceed the limits imposed by the sum rule even under favourable concession. This suggests that coherence effects are quite important and the production of photons cannot be considered as an incoherent addition of individual NNγ production processes. The deficiencies of present kinetic models may also apply for the production of probes such as the pion which do not couple perturbatively to the nuclear currents.

46015 (INIS-SU—40/A, pp 31-36) **Approximate differential Faddeev-type equations for systems of one light and two heavy particles.** Pupyshev, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW. (N—4(24)-87).

In JINR rapid communications. Collection.

Three-particle integro-differential equations are explored. The double-sum-representation of nonlocal operators is obtained. It is shown, that nonlocal operators may be approximate by the sum of local one, if the system consists of one light and two heavy particles. After such approximation original equations are reduced to approximate partial differential one. 5 refs.

46016 (INIS-SU—40/A, pp 37-41) **Inelastic scattering and fusion of heavy ions at near- and subbarrier energies.** Tarakanov, A.V.; Shilov, V.M. (Saratovskij Gosudarstvennyj Univ. (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW. (N—4(24)-87).

In JINR rapid communications. Collection.

It is shown that the multichannel model with the boundary conditions with account of only converging wave in internal region of nucleus describes well experimental data on fusion and inelastic cross sections of light nuclei at bear- and subbarrier energies, where the number of open channels is small. 12 refs.; 2 figs.

46017 (INIS-SU—40/A, pp 51-58) **Influence of mechanism of nuclear viscosity on formation of fission fragment distribution.** Adeev, G.D.; Serdyuk, O.I.; Pashkevich, V.V. (Omskij Gosudarstvennyj Univ. (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW. (N—4(24)-87).

In JINR rapid communications. Collection.

The influence of mechanism of nuclear viscosity on dynamics of the descent from saddle point to scission and on formation of fragment distribution is studied. The diffusion model based on the Fokker-Planck equation for the distribution function of collective variables for describing the dynamics of fission is used with the two-body and the surface one-day mechanisms of nuclear viscosity for calculating of the friction tensor. 15 refs.; 2 figs.; 2 tabs.

46018 **(ITEF—47(1987)) Calculation of total cross sections of K/sub L//sup 0/-meson-nucleus interaction and amplitude of K/sub L//sup 0/-K/sub S//sup 0/ regeneration on nuclei.** Galanina, N.D.; Memelov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702884/JAW.

Calculations of total cross sections of K/sub L//sup 0/-meson-nucleus interaction and amplitudes of K/sub L//sup 0/-K/sub S//sup 0/ regeneration on nuclei are performed according to the Glauber theory within K/sub L//sup 0/-meson pulse interval from 0.6 to 10 GeV/c for nuclei: C, Al, Cu, Sr, Sn, Nd, Pb, U. Comparison to experimental data is conducted. The calculations conducted describe well enough the known experimental data on both neutral and charged K-meson interaction with nuclei. This allows one to use similar calculations in those cases, when experimental data are not available. 20 refs.; 4 figs.; 5 tabs.

46019 **(JINR—R-2-87-762) Nuclear structure functions and cumulative processes.** Efremov, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 12p. (CONF-8709152—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703736/JAW.

From 18. international symposium on multiparticle dynamics; Tashkent, USSR (8 Sep 1987).

The author' point of view on nuclear quark structure is presented. Different models for explaining the EMC effect are reviewed. It is also shown that cumulative production data can be used to improve our understanding of the EMC effect and to give evidence for its multiquark nature. 26 refs.; 3 figs.

46020 **(LA-UR—88-1740) Calculation of ^{235}U(n,n') cross sections for ENDF/B-VI.** Young, P.G.; Arthur, E.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880546—27). NTIS, PC A02. Order Number DE88014480/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

Cross sections for neutron-induced reactions on ^{235}U between 0.01 and 20 MeV have been calculated in a preliminary analysis for the ENDF/B-VI evaluation with particular emphasis on neutron inelastic scattering. A deformed optical model potential that fits total, elastic, inelastic, and low-energy average resonance data is used to calculate direct (n,n') cross sections and transmission coefficients for a Hauser-Feshbach statistical theory analysis using a multiple fission barrier representation. Direct cross sections for higher-lying vibrational states are provided from DWBA calculations, normalized using B(E{ital l}) values determined from (d,d') and Coulomb excitation data. Initial fission barrier parameters and transition state density enhancements appropriate to the compound systems involved were obtained from previous analyses, especially fits to charged-particle fission probability data. Further modifications to fit ^{235}U(n,f) data were small, and the final fission parameters are generally consistent with published values. The results from this preliminary analysis are compared with the ENDF/B-V evaluation as well as with experimental data. 26 refs., 5 figs., 3 tabs.

46021 **(NEANDC—222-U) Use of the optical model for the calculation of neutron cross sections below 20 MeV.** (Nuclear Energy Agency, 75 - Paris (France)). 1986. 296p. (EN;FR). (CONF-851157—). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW.

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

This report gathers 25 communications which are analysed separately.

46022 (NEANDC—222-U, pp 291-295) **Report of the workshop on specific optical model parametrization for calculations.** Rapaport, J. (Ohio Univ., Athens (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

During the workshop, the parametrization of the optical model potential was reviewed. General observations about data and availability of computer codes were discussed. Three mass regions of interest in the nuclear field were considered: actinides nuclei, fission products nuclei and structural materials. General remarks were given.

46023 (NEANDC—222-U, pp 285-288) **Report of the workshop on tools for optical model calculations.** Dietrich, F.S. (Lawrence Livermore National Lab., CA (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The discussions in this workshop addressed both technical aspects of nuclear data calculations and the practical implications of recent developments in the physics of the optical model. The topics included code intercomparisons, and the needs for new codes and techniques for data evaluation. Also discussed were the needs for experimental data for further characterization of the new approaches. These included the use of energy-dependent geometries for the optical potential, microscopic methods, and an improved understanding of width fluctuation phenomena.

46024 (NEANDC—222-U, pp 279-284) **Proton optical model parameters from (n,p) reaction cross sections analysis.** Avrigeanu, M.; Ivascu, M.; Avrigeanu, V. (Institutul de Fizica si Inginerie Nucleara, Bucharest (RO); Institutul de Reactori Nucleari Energetici, Pitesti (RO)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Nuclear model calculations of the (n,p) reactions on /sup 46,47,48/Ti isotopes have been used to provide the proton optical model potential imaginary depth, characterized by an anomalous variation as a function of the atomic mass. Consistent sets of all other input parameters have been obtained or validated by means of various independent types of experimental data. The consistent account of the all proton emission data for the /sup 46-50/Ti isotopes has been finally achieved.

46025 (NEANDC—222-U, pp 267-270) **Analysis of neutron inelastic scattering from /sup 59/Co and /sup 93/Nb using the multistep compound pre-equilibrium theory.** Bonetti, R.; Hodgson, P.E. (Istituto di Fisica Generale Applicata, Milano, (IT); Nuclear Physics Lab., Oxford (UK)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The neutrons inelastically scattered from medium weight are almost isotropic, indicating a compound nucleus process. Their data are analysed via the statistical multistep compound theory of Feshbach, Kerman and Kooni. Theory is presented and comparison with experimental data is made.

46026 (NEANDC—222-U, pp 249-259) **Fast neutron scattering from soft nuclei: coupled-channel formalism and illustrations.** Delaroche, J.P. (CEA Centre d'Etudes de Bruyeres le Chatel, 91 (France)). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Spectra of most of the even-even nuclei have a character which is neither that of a pure vibrator nor that of a pure rotor. Instead, the nuclear spectra display very often both characters. Therefore, improvements in the analysises of nucleon scattering and reaction cross sections require that appropriate collective models of nuclear structure be used. A selection of these models is reviewed, and suggestions are given as to how to extend the familiar coupled-channel formalism to incorporate these enriched collective pictures. These extensions are primarily intended to describe inelastic scattering from levels belonging to β/sup -/, γ/sup -/ and octupole bands. Illustrations are given for neutron and proton scattering off various nuclei.

46027 (NEANDC—222-U, pp 233-247) **Use of the optical model in the actinide region.** Salvy, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

This paper reviews current methods as well as recent developments in the use of optical model for calculating actinide nuclear data in the incident neutron energy range from 10 KeV to 20 MeV. Special consideration is given of the general role of the model, par-

ametrization procedures with taking account of nuclear deformations, parameter sets to be recommended, and some utilization problems.

46028 (NEANDC—222-U, pp 221-232) **Inelastic scattering cross sections in the fission-product mass range.** Gruppelaar, H.; Van der Kamp, H.A.J. (Netherlands Energy Research Foundation, Petten). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Part of the reactivity contribution of fission products in fast reactors is due to inelastic scattering. Integral experiments in various fast facilities indicate that the inelastic scattering cross sections on the present fission-product nuclear data files are systematically too low for many even-mass nuclides. Possible reasons for this discrepancy are discussed. The neglect of direct-collective effects in the current evaluations seems one of the important omissions. This is confirmed by some recent differential data measured at low incident neutron energies. More experimental data are needed to study these effects. Corrections of the present nuclear-data files using DWBA or coupled-channels calculations are required for the next generation of nuclear data files.

46029 (NEANDC—222-U, pp 195-207) **Static and dynamical aspects of nuclear matter distribution: microscopic calculations and experimental data.** Girod, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

During the past ten years, a large amount of experimental data has been accumulated which gives information with regard to the sizes of the nucleus and the distribution of nuclear matter. Some particularly relevant results are presented. From a theoretical point of view, the contribution of the microscopic models is shown and particularly the results obtained by Hartree-Fock (HF) and Hartree-Fock-Bogoliubov (HFB) methods using D1 effective interaction. The agreement with experimental data is fairly good, taking into account the absence of parameters, and the theoretical proton and neutron density distributions have been used with success in the optical model calculations. The limitations of static calculations are also shown making necessary to take into account the dynamical effects, especially in shape transition regions. The densities obtained by the HF + RPA and HFB + Bohr hamiltonian theories are presented and compared to the experimental results.

46030 (NEANDC—222-U, pp 209-220) **Use of results from microscopic methods in optical model calculations.** Lagrange, Ch. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

A concept of vectorization for coupled-channel programs based upon conventional methods is first presented. This has been implanted in our program for its use on the CRAY-1 computer. In a second part we investigate the capabilities of a semi-microscopic optical model involving fewer adjustable parameters than phenomenological ones. The two main ingredients of our calculations are, for spherical or well-deformed nuclei, the microscopic optical-model calculations of Jeukenne, Lejeune and Mahaux and nuclear densities from Hartree-Fock-Bogoliubov calculations using the density-dependent force D1. For transitional nuclei deformation-dependent nuclear structure wave functions are employed to weigh the scattering potentials for different shapes and channels.

46031 (NEANDC—222-U, pp 183-193) **Fast neutrons and the optical model: some observations.** Smith, A.B.; Lawson, R.D.; Guenther, P.T. (Argonne National Lab., IL (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The optical model of fast-neutron-induced phenomena is considered from the observational viewpoint. Experimental characteristics governing the reliability of the modelling are outlined with attention to implications on model parameters and their uncertainties. The physical characteristics of experimentally-deduced regional and specific model parameters are examined including: parameter trends with mass and energy, implications of collective effects, and fundamental relations between real and imaginary potentials. These physical properties are illustrated by studies in the A=60 and 90 regions. General trends are identified and outstanding issues cited. Throughout, the approach is that of observational interpretation for basic and applied purposes.

46032 (NEANDC—222-U, pp 171-181) **Unresolved resonances and the optical model.** Frohner, F.H. (Kernforschungszentrum Karlsruhe (DE). Inst. Neutronenphysik und Reaktortechnik). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The last months brought a breakthrough in Hauser-Feshbach theory. The probability distributions of S- and R-matrix elements and the resonance-averaged cross sections for the statistical model of compound-nuclear reactions can now be expressed analytically in terms of transmission coefficients. This facilitates extraction of optical-model information from, and its utilisation in, the unresolved resonance range.

46033 (NEANDC—222-U, pp 159-169) **Optical models in the resolved resonance region.** Johnson, C.H. (Oak Ridge National Lab., TN (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Using modern time-of-flight facilities the resolved resonance region can be extended upward to about 1 MeV for nuclei with A<60 and for heavier nuclei near closed shells. A careful measurement both on and off resonances followed by a R-matrix analysis yields partial wave scattering functions which are easily energy averaged for comparison to those from an optical model. A comparison of average scattering functions of opposite parities can provide information on surface effects because the wave functions for different parities are out of phase at the surface. Thus, a unique supplement is made to the information that can be obtained from other types of measurements for both the bound region and higher energies.

46034 (NEANDC—222-U, pp 147-158) **Neutron and proton optical potentials.** Hansen, L.F. (Lawrence Livermore National Lab., CA (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The neutron and proton optical model potentials (OMP) are discussed in terms of microscopic (MOMP) and phenomenological (POMP) models. For the MOMP, two approaches are discussed, the nucleus matter approach [Jeukenne - Lejeune - Mahaux (JLM) and Brieva-Rook-von Geramb (BRVG), potentials] and the finite nuclei approach (Osterfeld and Madsen). For the POMP, the Lane charge-exchange potential and its validity over a wide mass range is reviewed. In addition to the Lane symmetry term, the Coulomb correction to both the real and imaginary parts of the OMP is discussed for the above models. The use of the OMP to calculate col-

lective inelastic scattering and observed differences between the neutron - and proton-deformation parameters is also illustrated.

46035 (NEANDC—222-U, pp 127-144) **Global and local optical model parametrizations.** Young, P.G. (Los Alamos National Lab., NM (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

A review is given of global and regional phenomenological neutron optical model parametrizations in the mass region above A = 40 and for neutron energies in the range 10 KeV-20 MeV. The performance of some 11 different neutron parametrizations is investigated for the case of /sup 58/Ni, utilizing Hauser-Feshbach statistical theory calculations of several reactions. A similar, more restricted analysis is made for neutron reactions on /sup 165/Ho, demonstrating the use of two useful approximations in deformed optical model calculations. A regional actinide potential is adapted for use with /sup 165/Ho and is shown to give reasonable results for /sup 165/Ho, /sup 238/U, and /sup 242/Pu.

46036 (NEANDC—222-U, pp 117-125) **Analysis of cross-sections of neutron-induced reactions from 1 to 20 MeV.** Hodgson, P.E. (Nuclear Physics Lab., Oxford (UK)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The calculated cross-sections of all the more important reactions of neutrons on /sup 59/Co and /sup 93/Nb are compared with the experimental data. The optical model is used to obtain the differential elastic scattering cross-section and the total and reaction cross-sections, and the Weisskopf-Ewing, Hauser-Feshbach and Feshbach-Kerman-Koonin theories for the compound and the statistical multistep compound contributions to the neutron emission cross-section. Several other reactions, in particular the (n, 2n), (n, p) and (n, α), are also studied.

46037 (NEANDC—222-U, pp 105-115) **Sensitivity of calculated cross sections on the optical model parameters.** Bersillon, O. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

After reminding the place of the optical model within the framework of nuclear data evaluation we present the sensitivity-analysis of physical quantities deduced from the optical model on the optical potential parameters in the particular case of the interaction n + /sup 209/Bi. This analysis is extended to the statistical model used at low incident energies. The consequences on the parameter fitting procedure are described.

46038 (NEANDC—222-U, pp 75-87) **Optical model and statistical processes.** Hofmann, H.M. (Erlangen-Nuernberg Univ., Erlangen (DE). Inst. fuer Theoretische Physik; Los Alamos National Lab., NM (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

It is shown by way of example that for light nuclear systems consistent models exist, which allow to calculate neutron cross-sections below 20 MeV. Due to the high level density energy-averaged cross-sections can be determined for larger nuclei. The energy-averaged cross-sections are decomposed into a direct part, calculated via the optical model, and a compound nuclear part, calculated via the statistics of the S-matrix. Various models allowing to calculate the compound nuclear cross-sections in different situations are presented. Experimental information on statistical properties is discussed.

46039 (NEANDC—222-U, pp 91-101) **International nuclear model codes comparisons.** Nagel, P.; Sartori, E. (NEA Data Bank, 91 Gif-sur-Yvette (FR)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The results of four international nuclear model code comparisons conducted by the NEA Data Bank are highlighted. These exercises have covered different aspects of neutron interaction with matter using a number of spherical-optical, coupled channel, statistical and pre-equilibrium model computer codes.

46040 (NEANDC—222-U, pp 63-73) **Coupled channel formalism and ECIS codes.** Raynal, J. (CEA, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

A new ECIS code is under study. It includes all the improvements which seemed to be necessary, including P. Moldauer's work on compound nucleus. Dirac formalism, used since some years to study elastic scattering was generalized to inelastic scattering. Besides the scalar and the vector potential, this formalism uses a tensor potential including a long range Coulomb contribution even for neutron scattering. Dirac equation can be written as a Schroedinger equation which is fully equivalent only for elastic scattering. Coupled Dirac or Schroedinger equations can be solved by iterations. Comparison of their results justifies the use of deformed spin-orbit potentials.

46041 (NEANDC—222-U, pp 53-61) **Limits on charge symmetry breaking in the nuclear mean field.** Austin, S.M. (Michigan State Univ., East Lansing (US). Dept. of Physics and Astronomy). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Evidence for charge symmetry breaking in the nucleon-nucleon and nucleon-nucleus context is reviewed. A first attempt to study charge symmetry breaking by comparing neutron and proton scattering on isospin zero nuclei is described; neutron potentials are found to be marginally more attractive that proton potentials, consistent with Negele's explanation of the Coulomb energy anomaly. However, significant uncertainties remain, particularly in the correction for core polarization effects.

46042 (NEANDC—222-U, pp 43-52) **Energy dependence of the shape of the optical model potential.** Finlay, R.W.; Petler, J.S. (Ohio Univ., Athens (US)). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Detailed studies of differential elastic neutron scattering from the heavy spherical nuclei /sup 208/Pb and /sup 209/Bi over a wide energy range (4 - 40 MeV) provide strong evidence that the geometrical parameters of the real potential well are not constant over this energy range. Both the root-mean-square radius and the volume integral per nucleon of the real potential well require sharp enhancement in the energy region from 4-7 MeV if excellent fits to recent, high-precision scattering measurements are to be obtained. This effect is qualitatively consistent with the theoretically expected dynamical (or ω-mass) corrections to the standard, non-local optical potential. Preliminary efforts to extract the parameters of the potential well directly from the data - without recourse to Woods-Saxon phenomenology - are discussed.

46043 (NEANDC—222-U, pp 29-40) **Microscopic calculations of the imaginary part of the optical model potential.** Osterfeld, F. (Kernforschungsanlage Juliech (DE). Inst. fuer Kernphysik). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

Microscopic calculations of the second order imaginary optical potential are presented for neutron and proton scattering from spherical target nuclei using random phase approximation transition densities for intermediate excited states. The contribution of the deuteron channel to the absorption is estimated. The sensitivity of the surface absorption on details of the nuclear structure wave functions is discussed. The calculations for the isoscalar term W/ sub 0/ of the optical potential, the isovector term W/sub 1/ (Lane-term), and the Coulomb correction term ΔW/sub C/ are reviewed. Successes and failures of the nuclear structure approach to the imaginary optical potential are discussed.

46044 (NEANDC—222-U, pp 17-27) **Definitions, limitations and calculations of the optical-model potential for neutrons below 20 MeV.** Mahaux, C.; Sartor, R. (Liege Univ. (BE). Inst. de Physique Nucleaire). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88754208/ JAW. (CONF-851157—).

From Specialists' meeting on the use of the optical model for the calculation of neutron cross sections below 20 MeV; Paris, France (13 Nov 1985).

The optical-model potential defined and calculated by the theorists is a much more complicated operator than the potential defined and determined by the phenomenologists. Together with the numerous approximations associated with any theoretical calculation, this essentially limits the practical usefulness of the theory to the rendering or to the prediction of the main features of the empirical optical-model potential. The identification of these main features is discussed, as well as the properties and interpretation of the dependence of these main features upon energy and mass number.

46045 **(RIFP—711) Progress in heavy ion resonance research.** Abe, Yasuhisa; Kato, Kiyoshi. (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Jul 1987. 13p. (CONF-8706113—7). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012578/JAW.

From 6. Adriatic international conference on nuclear physics: frontiers of heavy-ion physics; Dubrovnik, Yugoslavia (15 Jun 1987).

In order to clarify a present status of our research of resonance phenomena observed in heavy ion reactions, three current topics are selected to discuss in detail based on the results of recent investigations: Anharmonic vibration-rotation approaches, Resonances observed in heavier systems and so-called Landau-Zener resonance. 14 refs., 6 figs.

46046 **New insight into relativistic heavy ion physics through 4π data.** Gutbrod, H.H.; Doss, M.; Gustafsson, H.A.; Kolb, B.; Lohner, H.; Ludewigt, B.; Poskanzer, A.M.; Ritter, H.G.; Wieman, H. (Gesellschaft fur Schwerionenforschung, D-6100 Darmstadt (DE)). pp 236-257 of Local equilibrium in strong interaction physics (LESIP I). Scott, D.K.; Weiner, R.M. Teaneck, NJ; World Scientific Pub. Co. (1985). (CONF-8409358—).

From International course on observational and theoretical aspects of relativistic astrophysics and cosmology; Santander, Spain (3 Sep 1984).

The authors look at the question of thermalization - global or local, a look at the various apparent temperatures, the cluster production, the emission patterns and the sizes of the emitting systems. One of the major goals of relativistic heavy ion physics is to study the behaviour of nuclear matter at high temperature and density and to extract the equation of state of nuclear matter. It is of the utmost importance to find experimentally signatures that justify the concepts of bulk properties of nuclear matter like density, temperature, chemical equilibrium etc. Full thermalization of the participant nucleons has been postulated in the nuclear fireball model which in a later version also included chemical equilibrium for pions, nucleons and composite particles. Discrepancies with the data led to the discussion of the validity of hydrodynamics and the transparency of nuclei. However, in the analysis of single particle inclusive data a lack of sensitivity has been observed to the basic assumption of various models put forward to describe the interaction mechanism. This insensitivity results from the averaging implicit in such data over both the impact parameter and the correlation structure of the multiparticle final state.

6540 Radiation And Shielding Physics

46047 **(AD-A—192287/1/XAB) Calculations of neutron and gamma-ray transport in air-over-ground geometry: comparison with BREN and APR experiments. Technical report, 1 October 1982-31 May 1983.** Dolatshahi, F.; Kaul, D.C. (Science Applications International Corp., San Diego, CA (USA)). 1 Jun 1983. 116p. (SAIC—83-1200). NTIS, PC A06/MF A01.

Calculations of neutron and gamma-ray transport corresponding to the BREN and APR reactor experiments were performed using the two-dimensional, discrete-ordinates transport code DOTSAI. These calculations have been made as a test of state-of-the-art radiation transport techniques and to provide input for further analyses relevant to an ongoing program of Japanese A-bomb survivor dose reassessment. Comparisons of calculated and measured data have produced mixed results. However, it is concluded that modern calculational techniques are capable of accurately reproducing neutron and gamma-ray kerma and spectral distributions to large distances from Co-60 and fast reactor sources in an air-over-ground geometry.

46048 **(AD-A—192288/9/XAB) Calculation of the BREN Japanese house-shielding experiments. Technical report, 1 October 1982-1 May 1983.** Woolson, W.A.; Gritzner, M.L. (Science Applications International Corp., San Diego, CA (USA)). 22 Aug 1983. 66p. (SAIC—83-1020). NTIS, PC A04/MF A01.

The techniques used to calculate the house shielding as part of the dosimetry reassessment for the survivors of the Hiroshima and Nagasaki A-bombs are validated by modeling the Operation BREN Japanese house-shielding experiments and comparing calculated radiation transmission factors to the measured values. Single and two-story houses were modeled, as well as multiple house configurations. In all cases, the agreement for the ^{60}Co transmission and the reactor neutron transmission was excellent with most cases better than 10%. The agreement for the reactor gamma-ray transmission was poor; analysis indicates the discrepancy is probably due to problems in the measurements. The calculational procedure consists of performing a surface integral of the incident energy-angular fluence in air-over-ground geometries from the source with the energy-angular importance of the detector response in the three-dimensional house configuration. The air-over-ground fluence is computed by discrete ordinates; the importance function is computed by Monte Carlo in the adjoint mode. The excellent agreement obtained between the calculations and measurements for the ^{60}Co source and reactor neutrons demonstrates that the calculational procedure can provide accurate house transmission factors required in the dosimetry estimates for over half of the A-bomb survivors used in radiobiological-effects studies.

46049 **(BNL—41385) Ozone production due to synchrotron radiation.** Weilandics, C.; Rohrig, N.; Gmur, N.F. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 26p. (CONF-870610—26). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012889/JAW.

From 5. national synchrotron radiation instrumentation conference; Madison, WI, USA (21 Jun 1987).

Ozone production by synchrotron radiation as a function of power density in air was investigated using a white beam at the National Synchrotron Light Source (NSLS) x-ray ring. Power densities were calculated from the energy spectrum at 2.52 GeV. Ozone concentrations in small beam pipes were measures for power densities (I) between 10^{13} and 10^{15} eV{center←dot}cm^{-3}{center←dot} sec^{-1}. Large departures of the G-value describing ozone formation and k describing ozone destruction from previously published

values suggest that some undiscovered systematic error may exist in the experiment. This error may be related to beam hating effects and lack of uniform distribution of ozone within the sampled beam pipes. 19 refs., 7 figs.

46050 **(CTH-RF—58) Criticality and time eigenvalues for one-speed neutrons in infinite cylinders.** Sjoestrand, N.G. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics). Nov 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754471/JAW.

The transport equation for one-speed neutrons in an infinite cylinder in vacuum has been solved using the formalism of Sanchez and Ganapol. Fundamental and higher order eigenvalues were calculated for isotropic and linearly anisotropic scattering. From the real criticality eigenvalues the corresponding time-eigenvalues were evaluated. Also the real and complex values of the radii which give a decay constant at the Corngold limit were obtained.

46051 **(GSI—88-10) Two-dimensional hydrodynamic code for the interaction of intense heavy ion beams with matter based on the code CONCHAS SPRAY.** Schneider, V.; Rentzsch, T.; Maruhn, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1988. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754310/JAW.

In this report we describe a two-dimensional hydrodynamic code applicable to the problems stated. In section II we describe the algorithm solving the hydrodynamic equations. In section III we present test calculations involving the propagation of shocks and contact discontinuities as well as the growth of a Rayleigh-Taylor Instability (RTI). Section IV includes all the modifications and supplements required to use the code to investigate the interaction of intense HI beams with matter. Numcerical simulations of experiments using the RFQ facility and the planned SIS-ESR at GSI are finally discussed in section V. (orig./HSI).

46052 **(INIS-BR—1134) X-ray dynamic scattering by a crystalline plane.** Keller, W.A. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703234/JAW.

46053 **(INIS-BR—1136) Dynamic model of X-ray diffraction.** Campos, H.S. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703236/JAW.

46054 (INIS-SU—40/A, pp 22-30) **Influence of an absorbing sublayer on polarizing property of magnetic neutron mirrors.** Dokukin, E.B.; Korneev, D.A.; Lebner, V.; Pasyuk, V.V.; Petrenko, A.V.; Rzhany, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780099/JAW. (N—4(24)-87).

In JINR rapid communications. Collection.

Spectral dependence of the scattering length of natural Gd and GdTi alloy has been determined for the first time for the thermal neutron energy range. The scattering length of Gd was found to be unstable and consequently its compensation in a wide interval of neutron wavelength was impossible. This is the reason of the strong decreasing of the polarizing properties of neutron guides with ferromagnetic mirrors. The possibility is discussed of producing a new absorbing sublayer for polarizing neutron guides with an important decrease of reflection in the neutron wavelength range from 1 to 10 A. 7 refs.; 7 figs.

46055 **(LA-UR—88-2023) Elastic neutron scattering in UCd_{11}.** Thompson, J.D.; Lawson, A.C.; McElfresh, M.W.; Sattelberger, A.P.; Fisk, Z. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880704—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014426/JAW.

From 6. international conference on crystal field effects and heavy fermion physics; Frankfurt, F.R. Germany (18 Jul 1988).

We report results of neutron powder diffraction experiments on the heavy-electron magnet UCd_{11} at temperatures above and below its ordering temperature. These measurements set an upper limit on the ordered moment of 1.5μ/sub B//U. 7 refs., 1 fig.

46056 **(UCID—21445) Damage characterization of SOC mirrors, AGT-86.** Syn, C.K.; Edwards, D.F.; Wirtenson, G.R. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014696/JAW.

Twenty-three different coating designs were exposed to the intense soft x-ray radiation from the Blackjack 5 source. A number of post- test measurements were made to characterize the x-ray effects. Reported here are the results of the metallographic characterizations. The objectives were to identify the probable causes of any observed damage and to determine the damage mechanisms and their temporal behaviors. These characterization data have been correlated with light scattering data and code predictions to aid in the development of a fundamental understanding of the requirements for the survivability of optical coatings in a nuclear environment. 7 refs; 6 figs; 1 tab.

46057 **Hardness assurance based on system reliability models.** Browning, J.S.; Gover, J.E. (Sandia National Labs., P.O. Box 5800, Albuquerque, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-34**: No. 6, 1775-1781(Dec 1987). (CONF-8707112—).

From Annual conference on nuclear and space radiation effects; Snowmass Village, CO, USA (28 Jul 1987).

In this paper the problem of determining a piece-part test program based on system reliability objectives is considered. In particular we show how conventional single-sample plans can be extended to include a demonstration of system reliability by numerical simulation of system tests. A theoretical basis for test planning is suggested which may be of use to both producers and consumers of radiation hardened piece parts.

6550 Medical Physics

REFER ALSO TO CITATION(S) 46048, 46160

46058 (IAEA-TECDOC—440, pp 317-326) **Environmental radiation doses from tritium releases.** Devell, L.; Edlund, O. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The operation of fusion reactors will result in releases of tritium to the environment during normal operation due to the large inventory and the difficulty in retaining all leakages from systems containing tritium. Accidental releases may also occur. Many studies have been performed to calculate potential radiation doses in the environment due to releases to the atmosphere or to water recipients. Experience from real tritium releases due to the operation of different kinds of existing nuclear facilities is also available. In the present paper the radiation doses to individuals in the vicinity of a plant which releases tritium into the atmosphere and into different types of water recipients are discussed. A comparison is carried out for various release modes e.g. to different recipients or short term compared to prolonged releases. The importance of the various exposure pathways and dispersion/transport processes is discussed. Evaporation of tritiated water and oxidation of tritium gas to tritiated water are put into perspective. The collective dose due to tritium releases is dependent on recipient type and is reviewed. From the basic radiation protection criteria 0.1 mSv/year for individuals in the critical group and 10 manSv/GWe for the global collective dose, the restrictions on release quantities are discussed. (author). 25 refs, 1 fig., 3 tabs.

46059 **(INIS-mf—11264) Abstracts of submitted papers. VIIth national symposium on radiation dosimetry.** (Ceskoslovenska Akademie Ved, Prague. Ustav Dozimetrie Zareni). 7 Oct 1987. 154p. (CONF-8704316—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88703583/JAW.

From 7. national symposium on radiation dosimetry; Marianske Lazne, Czechoslovakia (13 Apr 1987).

The conference proceedings contain 152 abstracts of presented papers relating to various aspects of personnel dosimetry, the dosimetry of the working and living environment, various types of dosemeters and spectrometers, the use of radionuclides in various industrial fields, the migration of radionuclides on Czechoslovak territory after the Chernobyl accident, theoretical studies of some parameters of ionizing radiation detectors, and their calibration. (M.D.).

46060 **(PNL—6500-Pt.4) Pacific Northwest Laboratory Annual Report for 1987 to the DOE Office of Energy Research: Part 4, Physical Sciences.** Toburen, L.H. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 75p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014094/JAW.

This 1987 annual report from Pacific Northwest Laboratory describes research in environment, health, and safety conducted during fiscal year 1987. The report again consists of five parts, each in a separate volume. Part 4 includes those programs funded under the title "Physical and Technological Research." The Field Task Program Studies reports in this document are grouped by budget category and each section is introduced by an abstract that indicates the Field Task Proposal/Agreement reported in that section.

46061 **(SIS—1988:4) National institute of radiation hygiene and the medical application of radiation.** Baarli, J. (Statens Inst. for Straalehygiene, Oslo (Norway)). 1988. 20p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754494/JAW.

This paper gives a review of the rules and regulations concerning medical application of radiation in Norway. It discusses the intention of the regulations, the way in which the regulations is applied and how the National Institute of Radiation Hygiene as the competent authority assures the application of the regulations. The paper furthermore gives an indication of the areas of radiation application in medicine and the number of location of X-ray equipment, nuclear medical laboratories, radiation therapy equipment, etc. The number of X-ray examinations in Norway per year are also given, together with their distribution among the various types of examinations. Summary results of a quality assurance investigation of nuclear medical laboratories are given, as well as the results of inspections of the various types of equipment used in medical diagnostics.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 45050, 45393, 45962, 46098

46062 **(DOE/ER/45163—11) X-ray and γ-ray spectroscopy of solids under pressure: Annual technical progress report, October 1987-October 1988.** Ingalls, R.L. (Washington Univ., Seattle (USA). Dept. of Physics). 30 Jun 1988. Contract FG06-84ER45163. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012992/JAW.

This report summarizes studies of various materials at high pressures by means of x-ray and α-ray absorption spectroscopy. It is to be recalled that pressure is a fundamental thermodynamic variable. In particular it enables one to control the state of the material, such as liquid or solid, insulating or conducting, para- or ferromagnetic, etc. We have developed such techniques suitable for use with synchrotron radiation such as at the Stanford Synchrotron Radiation Laboratory (SSRL). Under the subject DOE grant we have successfully continued such work. We have also renewed our Moessbauer studies.

46063 **(DOE/ER/45233—3) Application of spin-sensitive electron spectroscopies to investigations of electronic and magnetic properties of solid surfaces and epitaxial systems: Progress report, 1 January 1988-31 December 1988.** Walters, G.K.; Dunning, F.B. (Rice Univ., Houston, TX (USA)). Jun 1988. Contract FG05-86ER45233. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012912/JAW.

Research during the third year of this grant has focused on: Application of electron spin labelling techniques to investigate the probing depths of secondary electrons as a function of energy of the incident primary electron beam, and to measure the contributions of rediffused primaries to secondary electron emission spectra. Use of electron spin polarized He(2^3S) metastable atoms to explore the dynamics of He(2^3S)-surface interactions by means of energy-resolved measurements of the polarization of electrons ejected from the surface by metastable atom impact. Recent research in this laboratory, with primary support from the Department of Energy, has resulted in new advances in Mott spin polarimetry that have been incorporated in both the Spin-Polarized Low Energy Electron Diffraction (SPLEED) and Spin-Polarized Metastable Deexcitation Spectroscopy (SPMDS) apparatuses. This important new capability enables energy and angle-resolved electron spin polarization measurements, thus extending the power and scope of spin-sensitive electron spectroscopies available for DOE-supported research. 13 refs., 3 figs.

46064 **(DOE/ER/45347—5) Strongly interacting fermion systems: Emphasis on heavy fermions: [Annual performance report].** Wilkins, J.W. (Ohio State Univ. Research Foundation, Columbus (USA)). [1988]. Contract FG02-88ER45347. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014127/JAW.

The research has been concentrated into three areas: Heavy fermions, exploratory studies of model systems related to high-T/ sub c/ superconductors and development of new methods for electronic properties.

46065 **(INIS-BR—1133) Electromagnetic wave multiple reflection in a periodic system of metallic and dielectric films.** Oliveira, N.B. de. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703233/JAW.

46066 **(INIS-BR—1135) Accurate determination of the orientation of monocrystals by Laue method.** Martins, M.dasG. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1984. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703235/JAW.

46067 **(INIS-BR—1156) Proceedings of the Brazilian Workshop on Semiconductor Physics.** (Universidade Estadual de Campinas (Brazil)). 1983. 36p. (CONF-830193—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW.

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

Studies on semiconducting materials are present. Mathematical models and/or experimental apparatus with nuclear techniques are proposed to analyse semiconductive properties and other characteristics. (M.C.K.).

46068 (INIS-BR—1156, pp 27) **Setting of experimental conditions for the study of lattice strain in silicon single crystal by x-ray line profile analysis.** Carvalho, C.A.M.; Pimentel, C.A.F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46069 (INIS-BR—1156, pp 28) **Study of microdefects in Sb-doped silicon-Czochralski.** Soares, D.A.W.; Pimentel, C.A.F. (Escola Federal de Engenharia de Itajuba, Minas Gerais (Brazil); Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46070 (INIS-BR—1156, pp 29) **Diffuse X-ray scattering near the Bragg reflexion of P-doped Czochralski silicon.** Stojanoff, V.; Pimentel, C.A.F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46071 (INIS-BR—1156, pp 31) **Electronic structure of the Si:O/sub 2/ complex.** Gomes, V.M.S.; Caldas, M.J.; Assali, L.V.C.; Leite, J.R.; Fazzio, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46072 (INIS-BR—1156, pp 33) **V/sub Ga/ and Cu in GaP through the MS-X/sub α/ with clusters of 29 atoms.** Makiuchi, M.; Fazzio, A.; Pereira Neto, J.R. (Brasilia Univ. (Brazil); Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46073 (INIS-BR—1156, pp 35) **Multiplet structure of GaAs:Mn, Fe/sup +/.** Pino Junior, A.D.; Fazzio, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. Tecnologico de Aeronautica; Sao Paulo Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46074 (INIS-BR—1156, pp 17) **Mott-exciton-plasma transition and stimulated emission in CdSe at 77 K.** Mol, A.W.; Muribeca, R.A.; Cardoso, C.L.N.; Meneses, E.A. de. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46075 (INIS-BR—1156, pp 30) **Radiation-induced paramagnetism in a-Si:H.** Pontuschka, W.M.; Carlos, W.W.; Taylor, P.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica; Naval Research Lab., Washington, DC (USA)). 1983. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703559/JAW. (CONF-830193—).

From 1. Brazilian school on semiconductor physics; Campinas, Brazil (31 Jan 1983).

46076 (INIS-mf—11260, pp 54) **Influence of light on the evolution of deuterium from a-Si:F:D.** Weil, R.; Busso, A.; Beyer, W. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Grenzflaechenforschung und Vakuumphysik). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46077 (LA-UR—88-2451) **The effect of vapor incidence angle upon thin film columnar growth.** Mazor, A.; Bukiet, B.G.; Srolovitz, D.J. (Los Alamos National Lab., NM (USA); Michigan Univ., Ann Arbor (USA). Dept. of Materials Science and Engineering). 1988. Contract W-7405-ENG-36. 21p. (CONF-881002—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014396/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

We present a generalized theory for the growth of columnar microstructure in vapor deposited thin films under the joint influence of a constant uniform deposition flux coming down with arbitrarily chosen incidence angle, and surface diffusion. The dependences of the Zone I to Zone II transition temperature, and the characteristic length scales associated with the unstable modes on the deposition angle are predicted. The surface morphology is obtained as a function of vapor incidence angle. For a specific deposition angle, there is a one-parameter family of steady-state surface profiles which corresponds to a range of possible columnar orientation angles, among which only one angle is associated with the tangent rule. These results agree with experimental observations. 10 refs., 6 figs.

46078 (LBL—25204) **Plasmon lineshape analysis in EELS of semiconductors.** Kundmann, M.K.; Gronsky, R. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 4p. (CONF-880841—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010358/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Many materials display plasmon peaks in their low-less EELS spectra. The plasmon peak shape, energy, and linewidth are characteristic of each materials and are sensitive to the outer-shell electron density and details of the electronic band and energy-level structures. As these properties are a function not only of the composition but also the structure and chemistry of a sample, plasmon spectroscopy can potentially become a materials characterization tool which goes beyond the elemental analyses provided by EDXS and ionization-edge EELS. However, analysis of plasmon spectra requires considerably more sophistication than either of the aforementioned techniques due to the possibility of overlapping spectrum features, the prevalence of plural scattering, and the difficulty in detecting and characterizing the often subtle differences between the plasmon spectra of similar materials. As yet, no systematic approach to plasmon analysis analogous to that available commercially for EDXS or EELS core-edge analysis has been developed. We present here an approach which, for the simple case of semiconductors, makes some progress in this direction. 4 refs., 2 figs., 1 tab.

46079 (MLM—3510(OP)) **Time-of-flight mass spectrometer for investigating hydrogen isotope interactions: H/D exchange rates at stainless steel and silicon surfaces.** Gill, J.T.; Watkins, D.B.; Rigano, J.N.; Clift, W.A.; Watkins, R.A.; Burwinkle, A.L.; Schultz, J.A.; Anderson, L.R.; Schmidt, H.K. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1988. Contract AC04-76DP00053. 9p. (CONF-880505—36). NTIS, PC A02. Order Number DE88012876/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

Time-of-flight Secondary Ion Mass Spectrometry/Direct Recoil (TOF SIMS/DR) techniques and apparatus are described which hold substantial promise for further understanding the behavior of hydrogen isotopes at surfaces. The analytic apparatus will be interfaced to a tritium-compatible exposure cell within a glovebox by means of a vacuum load-lock. Apparatus will consist of a pulsed Li/sup {plus}/ beam for H/D/T ratios (DR), a DC or pulsed Cs/sup {plus}/ beam for sputtering or TOF/SIMS (for enhancement of negative ion yields), and a dual channel 10 MHz time-digiting histogrammer for fast data rates. Prototype apparatus has already proven useful in understanding the rates at which hydrogen isotopes may be exchanged from material surfaces upon exposure to water vapor. An extremely fast and a second much slower process characterize the exchange at Si and stainless steel opxyhydroxide surface films. The fast process is limited by the rate at which water molecules strike the top monolayer of the surface. H/D exchange tunneling appears to be the bulk diffusion-limited exchange rate within the oxyhydroxide film. Diffusion constants have been derived: D/sub ex/ {minus} 10/sup {minus}19/ and 10 / sup {minus}20/ cm^2/sec for the films on 304SS and Si, respectively, at 298K and 1.3 {times} 10/sup {minus}4/ Pa (10/sup {minus}6/ torr) [H_2O]. D/sub ex/ for 304SS is consistent with previous results on α- FeOOH and SS. Diffusion exchange appears important in understanding the behavior of tritium permeation or contamination barriers. 52 refs., 7 figs.

46080 (RISO-M—2713) **X-ray diffraction study of the reconstructions induced by Sn and Pb on Ge(111) surfaces.** Skov Pedersen, J. (Risoe National Lab., Roskilde (Denmark)). Feb 1988. 104p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754489/JAW.

This report describes surface x-ray diffraction studies of Ge(111) surfaces covered by submonolayers of Sn and Pb. The first part is a brief review of the properties of the "clean" Si(111) and Ge(111) surfaces, of the properties of the Sn- and Pb-covered Ge(111) surfaces, and of the surface x-ray scattering technique. Part two of the report concerns x-ray scattering measurements on the α-phase of the Ge(111)√ 3x√ 3-Sn and the Ge(111)√3x√ 3-Pb reconstructions. The structure factor analysis shows a significant relaxation in the Ge substrate induced by the Sn/Pb adatoms. The registry of the adatoms is determined from the analysis of the integer-order reflections. The intensity profiles of the fractional-order Bragg rods display a pronounced variation, which is explained by subsurface relaxation extending four atomic layers into the bulk. Part three of the report describes the structure of the 7x7 and 5x5 reconstructions that are observed after deposition of submonolayers of Sn on the Ge(111) surface and subsequent annealing. The diffraction patterns for both structures show considerable similarity with the pattern for Si(111)7x7, and the analysis shows that the Dimer-Adatom-Stacking-fault (DAS) model also is applicable to the Sn-induced Ge(111)7x7 and Ge(111)5x5 structures. The adatoms are identified to be Sn. The results of the refinement of the atomic coordinates show that the atoms in the upper five atomic layers are displaced from their ideal positions. The displacements around the adatoms are similar to the displacements of the Ge(111)√3x3-Sn surface. Furthermore, the observed relaxations are in good agreement with the predictions of total-energy calculations. A series of elastic strain calculations by the Keating model have been carried out. It is demonstrated that this model gives a good description of the atomic relaxations of the Ge(111)√3x√3-Sn (Pb), Ge(111)7x7-Sn, and Ge(111)5x5-Sn surfaces. 127 refs.

46081 **(SAND—88-0133) Back-thinning technique for TEM [Transmission electron microscopy] examination of thin films on sapphire (Al_2O_3).** Moran, M.P. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014230/JAW.

Transmission electron microscopy (TEM) studies of vapor deposited, beam-treated (ion, electron and laser) samples require onsided thinning in order for the treated layers to be examined. The purpose of this report is to describe a technique for thinning Al(sub 2)O(sub 3) (sapphire) substrates on which Al-Mn alloys have been deposited in order to obtain elctron-transparent thin area of the alloy layer. These detailed mechanical thinning procedures resulted in an average specimen preparation time of {approximately}1/2 day with a success rate above 90 percent whereas early attempts required {approximately}2 days per specimen with a success rate below 50%. 6 figs.

46082 **Application of supercomputers to model fluid transport and chemical kinetics in chemical vapor deposition reactors.** Kee, R.J.; Evans, G.H.; Coltrin, M.E. (Computational Mechanics Div., Sandia National Labs., Livermore, CA (US)). pp 334-352 of Supercomputer research in chemistry and chemical engineering. Jensen, K.F.; Truhlar, D.G. Washington, DC; American Chemical Society (1987). (CONF-8703229—).

From Symposium on supercomputer research in chemistry and chemical engineering; Minneapolis, MN, USA (16 Mar 1987).

Using a rotating-disk chemical vapor deposition (CVD) reactor as an example, the authors discuss the application of supercomputing to simulation of gas-phase chemical kinetics and fluid transport. Because a simulation that simultaneously incorporates multidimensional fluid transport and complex chemical kinetics is impractical, the authors break the simulation into pieces that are appropriate for today's supercomputers. The analysis takes advantage of similarity transformations that, in certain operating regimes, reduce the governing equations to a one-dimensional boundary value problem. The regions in which these transformations are valid are determined through extensive two-dimensional fluid mechanical simulations of the carrier gas alone. For the boundary value problem, a full elementary gas-phase chemical reaction mechanism can be included in the analysis. In addition to discussing the rotating-disk CVD analysis, the authors discuss their approach to software implementation, which makes simulating large chemical systems practical.

6561 Superconductivity

REFER ALSO TO CITATION(S) 45393, 46062, 46064

46083 **(DOE/ER/45268—2) Studies of heavy fermion systems: Progress report, July 1, 1986-December 31, 1988.** Stewart, G.R. (Florida Univ., Gainesville (USA)). 1988. Contract FG05-86ER45268. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012819/JAW.

Major projects put forward in the original proposal were: radiation damage studies of the heavv fermion superconductors UBe_{13} and UPt_3; chemical substitution experiments, including CeCu/sub 6-x/M/sub x/; high magnetic field specific heat measurements; search for new heavy fermion systems (HFS). A summary of results on these projects will be discussed first, followed by additional work done during the contract period - some of which is still in progress.

46084 **(LBL—25392) Some theoretical aspects of high T/sub c/ superconductivity.** Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 6p. (CONF-871072—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013101/JAW.

From Low temperature electronics and high temperature superconductors symposium; Honolulu, HI, USA (19 Oct 1987).

This paper is concerned with properties of new superconducting oxides discovered and with mechanisms of high T/sub c/ superconductivity. At present, there are many experimental data which allow us to conclude that we are dealing with very unusual systems. At the same time, we should stress that the new superconducting oxides display usual, BCS-type superconductivity. This means that: the superconducting state is due to an effective electron-electron attraction caused by some intermediate field, this attraction leads to Cooper pairing, and the spectrum of excitations possesses an energy gap. However, this state has many peculiar features, such as a small coherence length, non-phonon contribution to the pairing, and a multigap structure. 14 refs.

46085 **(PB—88-200159/XAB) Superconductivity near the atomic limit of the Anderson lattice.** Gunn, J.M.F.; Long, M.W. (Rutherford Appleton Lab., Chilton (UK)). Dec 1987. 35p. (RAL—87-110). NTIS, PC E04/MF E04.

The authors present an argument that derives electron-pairing correlations in a system whose many-body interactions are all repulsive. They analyze the spin-half Anderson Lattice in the nearly atomic limit through the nonlinear-hopping Hamiltonian developed in the companion paper. In a mean field analysis, they found a competition between magnetism in the truly atomic limit to superconducting pairing correlations as the kinetic energy is increased. They found singlet pairing solutions with a constant gap on the Fermi surface at some distance from the magnetic solutions. Further, they found the possibility of a weaker instability towards odd-parity triplet pairing, with zeroes of the gap on the Fermi surface, between these two coherent phases.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 45517, 45587, 45937

46086 **(DOE/ER/25026—22) Implementation of fitted second order ODE integrators.** Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jul 1988. Contract FG02-87ER25026. 7p. (UIUCDCS-R—88-1441; UILU-ENG—88-1746). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013956/JAW.

The fixed step size integration of a system of second-order ODES without first derivatives can most efficiently be implemented using backward differences (if variable step sizes are needed, modified backward differences appear to be the most efficient[2]). This note indicates how to modify these methods so that they are exact for solutions of the form e{sup {lambda}t} for specified values of {lambda}. These appear to be particularly promising for the equations of planetary motion in which {lambda} = i{omega}, where {omega}/2{pi} is the rotational frequency. 3 refs.

46087 (INIS-mf—11260, pp 3) **Universality and scaling in disordered electronic systems.** Cohen, A.; Roth, Y.; Shapiro, B. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

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46088 (INIS-mf—11260, pp 5) **Crumpling transition: energy vs. entropy in membranes.** Kantor, Y. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46089 (INIS-mf—11260, pp 7) **Phase-space approach to quantum theory.** Marinov, M.S. (Hebrew Univ., Jerusalem (Israel)). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46090 (INIS-mf—11260, pp 8) **Global energy conservation law in general relativity.** Nissani, N.; Leibowitz, E. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46091 (INIS-mf—11785) **Bound states in curved quantum waveguides.** Exner, P.; Seba, P. (Ceskoslovenska Akademie Ved, Rez; Karlova Univ., Prague (Czechoslovakia). Nuclear Centre). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)). 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754338/JAW.

BiBoS.; no. 298/87.

We study free quantum particle living on a curved planar strip Ω of a fixed width d with Dirichlet boundary conditions. It can serve as a model for electrons in thin films on a cylindrical-type substrate, or in a curved quantum wire. Assuming that the boundary of Ω is infinitely smooth and its curvature decays fast enough at infinity, we prove that a bound state with energy below the first transversal mode exists for all sufficiently small d. A lower bound on the critical width is obtained using the Birman-Schwinger technique.

46092 (JINR—R-11-87-434) **Numerical investigation of the Sine-Gordon equation with singularity solution behaviour at large t.** Kazacha, G.S.; Serdyukova, S.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702941/JAW.

Submitted to the organizing comittee of International summer school on nonlinear differential equations, Varna 28-3 Oct 1987.

The existance conditions of the periodic regimes inside the Josephson junction of finite length with microhomogeneity are studied. The sine-Gordon equation with singularity phi/sub tt/ =phi/sub xx/-aphi/sub t/-(1-μδ(x))sinphi+γ(t) is solved numerically. The solutions of kind ω+rho(x,t) existance are established. Here rho(x,t) is finite, periodic function of t. Similar solutions are observed also in homogeneous junction (when μ=0). We suceeded to excite the periodic regimes by varying the current function γ(t). New periodic regimes are obtained. The dependence ω on γ (current-voltage characteristics) graphes are presented. The approximate formulae ω(γ, α) of nonlinear part of the resistive branch is derived. The behaviour of rho(x,t) for different branches of the current-voltage characteristics is studied. 6 refs.; 17 figs.

46093 (LA—11329-MS) **Development and testing of KITES.** Murphy, T. (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015057/JAW.

KITES is a first-principles kinetic theory computer code for modeling the behavior of atmospheric electrons in the presence of strong, short-duration, fast-risetime or high-frequency electromagnetic fields. In this report we describe the development and testing of this code, including a complete description of the kinetic theory model used in the code, the model's range of validity, and the numerical methods used to solve the resulting equations. The model uses only experimentally measured cross sections as input and contains no free parameters. To check the validity of our model, we compare the results of KITES calculations with an analytic model and experimentally measured steady-state electron transport parameters and find excellent agreement. 20 refs., 4 figs., 16 tabs.

46094 **Singularity spectrum for period n-tupling in area-preserving maps.** Kim, S.; Hu, B. (Department of Physics, University of Houston, Houston, Texas 77204). *Physical Review [Section] A: General Physics;* **38**: No. 3, 1534-1537(1 Aug 1988).

The singularity spectrum f(α) and the generalized dimension D(q) of the critical orbit is numerically obtained to study the global scaling behavior of period n-tupling (n = 2,3,4) in area-preserving maps. It is found that f(α) becomes quite different as n is changed, and the generalized dimension D(q) increases for all q as n increases. The global scaling behavior of conservative systems is different from that of dissipative systems. Moreover, for conservative systems, the global scaling behavior seems to depend on dimensionality.

70 FUSION ENERGY

46095 (TRITA-EPP—86-17) **Publications from the department of plasma physics and the unit of acceleration technology. Index and abstracts 1986.** (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). [1987]. 23p. NTIS (US Sales Only), PC A03/MF A01 - Royal Inst. of Technology, Dept. of Plasma Physics and Fusion Research, S-10044 Stockholm, Sweden. Order Number DE88754503/JAW.

7001 Plasma Research

REFER ALSO TO CITATION(S) 46183

46096 (CLM-R—281) **Impurity control limiter experiment.** Matthews, G.F.; Fielding, S.J.; McCracken, G.M. and others. (UKAEA Culham Lab., Abingdon). Nov 1987. 40p. H.M. Stationery Office, London, price Pound 5.00.

In this paper we present results from the impurity control limiter experiment (ICL), which was installed on the DITE tokamak. Our experiments confirm that the impurities sputtered from the ICL are ionised predominantly in the scrape-off layer and that there is significant deposition of neutral carbon on the walls. Both the spatial distribution of ionisation and the toroidal distribution of the carbon on the walls are in good agreement with code predictions. Insertion of the ICL resulted in a 50% reduction of the total radiation in helium discharges and a 10% reduction in the loop voltage when compared with rail limiters of conventional geometry. In deuterium the reduction in the total radiation was only 20% and this is attributed to the greater importance of the wall sources of carbon and oxygen in deuterium plasmas relative to those in helium.

46097 (CTH-IEFT-PP—1987-13) **Nonlinear wave propagation in collisionless finite-β inhomogeneous plasmas.** Katou, K.; Weiland, J. (Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics). 1987. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754469/JAW.

Three coupled nonlinear evolution equations for the electrostatic potential, the density fluctuation and the longitudinal vector potential are derived from the two-fluid and Maxwell's equations which describe low-frequency collisionless finite-β inhomogeneous plasmas. Under the assumption of weak turbulence the above equations reduce to the nonlinear Schroedinger equation. The technique adopted here is considered as an extension of the formal Karpman-Krushkal method to a system of nonlinear partial differential equations. The general exact traveling wave solution to the nonlinear Schroedinger equation is obtained with the help of Hamilton-Jacobi theory. This general solution may be regarded as describing a final nonlinear stage of the modulational instability. It is also shown that a solitary wave solution to the nonlinear Schroedinger equation, which corresponds to the limiting case of the general solution, is given by means of the simple iterative method. (authors).

46098 (DOE/DP/40200—71-Vol.34) LLE [Laboratory for Laser Energetics] review: Quarterly report, January-March 1988. Kelly, J. (ed.). (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1988. Contract FC08-85DP40200. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012566/JAW.

This volume of the LLE Review, covering the period January-March 1988, contains articles on the spectra of scattered laser radiation from laser-produced plasmas and on the bounce coating of ablation layers on fusion targets. The advanced technology section has reports on a novel technique for characterizing surface breakdown on semiconductor devices and on a versatile alexandrite regenerative amplifier. Finally, the activities of the National Laser Users. Facility and the GDL and OMEGA laser facilities are summarized. 49 refs., 30 figs.

46099 (DOE/DP/40200—73) A code for the solution of the Vlasov-Fokker-Planck equation in one or two dimensions. Epperlein, E.M.; Rickard, G.J.; Bell, A.R. (Rochester Univ., NY (USA). Lab. for Laser Energetics). Jul 1988. Contract FC08-85DP40200. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013288/JAW.

We describe a code for the solution of the Vlasov-Fokker-Planck (VFP) equation in one or two spatial dimensions using the diffusive approximation in configuration space. The equations are integrated by the Alternating Direction Implicit (ADI) method. We give examples of its application to the simulation of laser-produced plasmas. 20 refs., 4 figs.

46100 (DOE/ER/53175—4) Collisional processes of interest in MFE plasma research: Annual report, August 1, 1987-July 31, 1988. Olson, R.E. (Missouri Univ., Rolla (USA). Dept. of Physics). 8 Jul 1988. Contract FG02-84ER53175. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013221/JAW.

Research on this grant is devoted to the calculation of heavy particle collision cross sections needed for diagnostic studies of magnetic fusion plasmas. This work requires the development and testing of new theoretical techniques, and the implementation of benchmarked methods to collisions pertinent to fusion reactors. In the last context, we have provided the cross sections needed for modelling of charge exchange recombination on ASDEC, Rutherford scattering experiments on JT-60, carbon pellet based alpha particle diagnostics for CIT, and a proposed current drive application for ITER. Further, a large compilation of n{ell} charge exchange cross sections for C^{6+} and O^{8+} collisions has been made for the inclusion in major IAEA report on this subject.

46101 (DOE/ER/53176—4) Theoretical plasma physics: Progress report, January 1, 1988-October 31, 1988. Boozer, A.H.; Vahala, G.; Tracy, E.R. (College of William and Mary, Williamsburg, VA (USA)). Jun 1988. Contract FG05-84ER53176. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014285/JAW.

During the past year we have studied the effect of magnetic islands on transport. Plasma properties near a magnetic separatrix, tokamak current drive, transport in tokamaks with ripple, methods for integrating magnetic field line equations that permit very long integration steps, alpha particle diagnostics that utilize the scattering of light from CO_2 laser or millimeter sources, and models of plasma turbulence. These are briefly discussed in this paper.

46102 (DOE/ER/53201—3) Stellarator theory: Progress report. Hitchon, W.N.G. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Jul 1988. Contract FG02-85ER53201. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014131/JAW.

This paper discusses progress in the following areas: The propagator method; ripple transport in tokamaks; self-consistent bounce-averaged numerical transport; computations: The bootstrap current; comparisons of stellarator ripple transport calculations; and plasma transport in IMS using a 1D fluid transport code.

46103 (DOE/ER/53223—67) [Research programs in plasma physics]: Annual report. Weitzner, H. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences). [1988]. Contract FG02-86ER53223. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013090/JAW.

This paper contains a brief review of the work done in 1987 at New York University in plasma physics. Topics discussed in this report are: reduction and interpretation of experimental tokamak data, turbulent transport in tokamaks and RFP's, laminar flow transport, wave propagation in different frequency regimes, stability of flows, plasma fueling, magnetic reconnection problems, development of new numerical techniques for Fokker-Planck-like equations, and stability of shock waves. Outside of fusion there has been work in free electron lasers, heating of solar coronal loops and renormalized theory of fluid turbulence.

46104 (DOE/ER/53266—1) Plasma confinement theory and transport simulation: Technical progress report, October 1, 1987-October 14, 1988. Ross, D.W. (Texas Univ., Austin (USA). Fusion Research Center). Jun 1988. Contract FG05-88ER53266. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012910/JAW.

An overview of the program has been given in the recent proposal. The principal objectives are to provide theoretical interpretation and computer modelling for the TEXT tokamak, and to advance the simulation studies of tokamaks generally, functioning as a national transport computation facility. We also carry out equilibrium and stability studies in support of the TEXT upgrade, and work continues, at low levels, on Alfven waves and MFEnet software development. The specific focus of the program is to lay the groundwork for detailed comparison with experiment of the various transport theories, so that physics understanding and confidence in predictions of future machine behavior will be enhanced. This involves to collect, in retrievable form, the data from TEXT and other tokamaks to make the data available through easy-to-use interfaces; to develop criteria for success in fitting models to the data; to maintain the Texas transport code, CHAPO, and make it available to users; to collect theoretical models and implement them in the transport code; and to carry out the simulation studies and evaluate the fits to the data. 37 refs.

46105 (DOE/ET/53088—4) Institute for Fusion Studies progress report for period November 1, 1987 to October 31, 1988. Baldwin, D.E. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1988. Contract FG05-80ET53088. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012909/JAW.

During FY 1987, a number of noteworthy scientific advances were achieved in keeping with the Institute's mandate to investigate both fundamental problems as well as near-term issues. Fundamental work ranged from ion temperature gradient-driven turbulence, nonlinear drift wave vortices, and orbital stochasticity, to sophisticated techniques for particle, fluid, and hybrid numerical simulations. Investigations with near-term relevance concerned sawteeth and heat pulse simulations, alpha particle ignition physics, and tokamak limiter sheaths. It is of interest to note that a number of advanced fusion-related ideas were also studied: a new proposal for a muon-catalysis reactor, free electron laser sideband instabilities, the Z-pinch fiber, and beat-wave accelerators. In addition, some space physics problems of generic application to plasmas are considered.

46106 (INIS-mf—11260, pp 68) **X-ray laser gain from bragg reflection coupling in channeled relativistic beam systems.** Strauss, M.; Amendt, P.; Ron, A. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev (Israel). Dept of Physics; California Univ., Irvine (USA). Dept. of Physics; Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46107 (INIS-mf—11260, pp 69) **On the possiblity of steady state negative mobility in externally ionized gas mixtures.** Rozenberg, Z.; Lando, M.; Ronki, M. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46108 (INIS-mf—11260, pp 70) **Spectroscopic determination of particle fluxes and charge-state distributions in a pulsed diode plasma.** Perelmutter, L.; Sarid, E.; Foord, M.E.; Sarfaty, M.; Maron, Y. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46109 (INIS-mf—11260, pp 71) **Time dependent spectroscopic observation of the magnetic field in a high-power-diode plasma.** Sarid, E.; Zahavi, O.; Nahshoni, E.; Maron, Y. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46110 (INIS-mf—11260, pp 72) **Electron temperature and heating processes in a dynamic plasma of a high power diode.** Sarfaty, M.; Perelmutter, L.; Zahavi, O.; Foord, M.E.; Sarid, E.; Maron, Y. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46111 (INIS-mf—11260, pp 73) **Nolocal analysis of the lower-hybrid drift instability.** Fruchtman, A. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46112 (INIS-mf—11260, pp 74) **Computation of the double z pinch with a long lifetime.** Bar-Avraham, E. (Rafael Ballistic Center, (Israel)). 1988. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780098/JAW. (CONF-8803131—).

From Israel Physical Society annual meeting; Haifa, Israel (28 Mar 1988).

Bull. Isr. Phys. Soc. ; Vol. 34.

46113 **(JET-R—88-01) HECTOR: a code for the study of high energy charged particles in axisymmetric tokamak plasmas.** Kovanen, M.A.; Core, W.G.F. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754144/JAW.

A code for the study of high energy charged particles resulting primarily from thermonuclear reactions within the confining magnetic fields of non-circular axisymmetric tokamak plasmas is described. The trajectories of the particles are traced in the (C.O.M.) space using a new, fast, and efficient hybrid orbit following scheme based upon the drift equations in the guiding centre approximation and the constants of motion. The code includes the important Coulomb scattering processes of dynamical friction and pitch angle scattering. The code is specifically designed to operate within the experimental environment or in a predictive mode.

46114 **(Juel—2173) Transport through dissipative trapped electron mode and toroidal ion temperature gradient mode in TEXTOR.** Rogister, A.; Hasselberg, G.; Waelbroeck, F.; Weiland, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics). Dec 1987. 82p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754345/JAW.

A self-consistent transport code is used to evaluate how plasma confinement in tokamaks is influenced by the microturbulent fields which are excited by the dissipative trapped electron (DTE) instability. As shown previously, the saturation theory on which the code is based has been developed from first principles. The toroidal coupling resulting from the ion magnetic drifts is neglected; arguments are presented to justify this approximation. The numerical results reproduce well the neo-Alcator scaling law observed experimentally - e.g. in TEXTOR - in non detached ohmic discharges, the confinement degradation which results when auxiliary heating is applied, as well as a large number of other experimental observations. We also assess the possible impact of the toroidal ion temperature gradient mode on energy confinement by estimating the ion thermal flux with the help of the mixing length approximation.

46115 **(ORNL/TM—10698) H/sub α/ monitors for the Advanced Limiter Test-II (ALT-II) on TEXTOR.** Uckan, T. (Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013506/JAW.

The H/sub α/ monitor system installed on TEXTOR in conjunction with the Advanced Limiter Test-II (ALT-II) toroidal belt pump limiter is introduced. The monitors are used to study edge particle fluxes and recycling, correlations to confinement properties of core and edge plasma with ALT-II, and also high-power auxiliary heating ({approximately}5 MW) during long-pulse ({approximately}4-s) operation of TEXTOR. A model of the edge particle flux based on the H/sub α/ measurements is presented. The ALT-II experiments are to be carried out in various phases. Here we discuss the results obtained from the monitor system during the initial phase of operations following the installation of the ALT-II limiter, with ohmic heating only. 15 refs., 21 figs.

46116 **(PFC/JA—88-17) Γ-ray diagnostic for the Compact Ignition Tokamak.** Petrasso, R.D.; Fiore, C.L.; Li, Chi-Kang. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Apr 1988. Contract AC02-78ET51013. 9p. (CONF-880364—31). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011525/JAW.

From 7. topical conference on high temperature plasma diagnostics; Napa, CA, USA (13 Mar 1988).

We have examined the feasibility of a fusion γ-ray diagnostic for the Compact Ignition Tokamak, which is expected to produce 10^{20} (d,t) fusion reactions per second. Gamma rays at 16.7 MeV are

produced by the t(d,γ)He^5 fusion reaction. A Monte-Carlo coupled neutron-photon transport code is used to model the expected γ-ray spectrum incident upon a Compton spectrometer backed by a Cerenkov detector. The results indicate that a signal of {approximately}3 x 10^{4}cts/s and a signal-to-noise ratio of {approximately}30 can be achieved. 8 refs., 4 figs.

46117 (PPPL—2527) Boundary conditions for OH, L, and H-mode simulations. Singer, C.E.; Bateman, G.; Stotler, D.P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1988. Contract AC02-76CH03073. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012993/JAW.

A method for prescribing appropriate boundary conditions for predictive simulations using flux-surface-averaged plasma transport codes is described. The model makes use of the present theoretical understanding of L and H-mode transport mechanisms and is consistent with trends in existing data. It is calibrated against an ASDEX experiment and used to predict the edge behavior in CIT. 14 refs., 7 figs.

46118 (PPPL—2529) Superthermal electron distribution measurements from polarized electron cyclotron emission. Luce, T.C.; Efthimion, P.C.; Fisch, N.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1988. Contract AC02-76CH03073. 23p. (CONF-880364—32). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012994/JAW.

From 7. topical conference on high temperature plasma diagnostics; Napa, CA, USA (13 Mar 1988).

Measurements of the superthermal electron distribution can be made by observing the polarized electron cyclotron emission. The emission is viewed along a constant magnetic field surface. This simplifies the resonance condition and gives a direct correlation between emission frequency and kinetic energy of the emitting electron. A transformation technique is formulated which determines the anisotropy of the distribution and number density of superthermals at each energy measured. The steady-state distribution during lower hybrid current drive and examples of the superthermal dynamics as the runaway conditions is varied are presented for discharges in the PLT tokamak. 15 refs., 8 figs.

46119 (PPPL—2533) Measurements of neutral beam species, impurities, spatial divergence, energy dispersion, pressure, and reionization for the TFTR [Tokamak Fusion Test Reactor] US Common Long Pulse Ion Source. Kugel, H.W.; Gammel, G.M.; Grisham, L.R.; Kaita, R.; Kamperschroer, J.H.; Langley, R.A.; Magee, C.W.; Medley, S.S.; Murphy, T.J.; Roquemore, A.L.; Williams, M.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1988. Contract AC02-76CH03073. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88012998/JAW.

Physical characteristics of TFTR neutral beams were measured during the first tests and initial operating experience with production TFTR US Common Long Pulse Ion Sources on beamlines in the TFTR experimental environment under actual user conditions. These measurements were performed with different power supply systems, controls, diagnostics, and operating methods compared to those used at LBL during the development phase. The set of diagnostics included water calorimetry, thermocouples, vacuum ionization gauges, photodiodes, neutron, gamma-ray and charged particle backscatter spectroscopy, and implantation/secondary ion mass spectroscopy. These systems were used to perform complementary measurements of neutral beam species, measurements were performed either in the neutralizer region, where the beam contained both ions and neutrals, or in the region of the output neutral beam. In general, consistent with estimates made during the LBL development phase. They can provide guidance for the optimization of TFTR neutral beam heating operations and the understanding of auxilliary heated TFTR plasmas. 21 refs., 28 figs., 2 tabs.

46120 Microwave emission and beam propagation measurements in a high-power relativistic electron beam-plasma system. Di Capua, M.S.; Camacho, J.F.; Fulkerson, E.S.; Meeker, D. (Lawrence Livermore National Lab., Univ. of California, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 217-224(Apr 1988).

The authors measured microwave emission from a system consisting of an unmagnetized plasma (T/sub e/ ≃ 1 eV, 0.8 < n/sub e/ < 2.3 x 10/sup 11/ cm/sup -3/) and a propagating electron beam (I/sub b/ ≃ 50 kA, V/sub b/ ≃ 1.4 MV, J/sub b/ ≃ 280 A/cm/sup 2/, t/sub rise/ ≃ 35 ns, t/sub pulse/ ≃ 60 ns). A 93-cm/sup 2/ velvet cathode, with an anode-cathode gap of 5.9 cm, injects the electron current into the plasma through an aluminized Mylar anode. The authors measure diode voltage and current in the 6-Ω water dielectric accelerator and net current through the beam-plasma system. The plasma is produced by a 90-μs, 90-A current pulse, emitted from a thermionic LaB/sub 6/ electron source, which preionizes a 0.8 < rho/sub o/ < 4.6 mT argon fill in a 1-m-long, 15-cm-diameter Lucite tube. A microwave spectrometer detects the radio-frequency output in the 2-18, 18-26, and 26-47 GHz bands, which a set of filters then separates into narrower subbands. The emission takes place in two distinct phases. The 2-6-GHz output, which includes f/sub rho/, rises promptly with the current pulse and then decays. At 6 GHz and above, a low-level microwave prepulse appears simultaneously with the 2-6-GHz output. This output rises sharply 25 ns after the current pulse begins and includes frequencies out to and beyond 40 GHz. The radio-frequency output falls off before the current pulse ends. The microwave intensity decays monotonically with frequency.

46121 Electron density and temperature in the pulsed-orbitron-maser glow discharge. Rader, M.; Dyer, F.; Alexeff, I. (Electrical Engineering Dept., Univ. of Tennessee, Knoxville, TN (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 270-274(Apr 1988).

In order to better understand the pulsed-glow discharge that provides the feed electrons for our pulsed-orbitron maser, the authors have been using penetrating microwave beams and radially inserted Langmuir probes to make bulk and radial measurements of the number density in the plasma. They have also used the Langmuir probe to measure the electron temperature across the plasma radius, and they investigated the effects of an externally applied magnetic field on the RF output of the orbitron. The authors found that the emitted frequency is apparently not related to the electron plasma frequency by any simple linear relationship, and that an externally imposed magnetic field of as little as 70 G is required to kill the instability.

46122 Cubic dispersion relation for a relativistic backward-wave oscillator. Brandt, H.E.; Uhm, H.S. (Harry Diamond Labs., Adelphi, MD (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 264-269(Apr 1988).

The cubic approximation to the dispersion relation for a relativistic backward-wave oscillator is obtained, and the utility and limits of the approximation are presented. The approximation is obtained by Taylor series expansion of the wave admittance in the dispersion relation for the transverse-magnetic and free-streaming modes of a relativistic, thin, hollow, cylindrical electron beam moving along the axis of a disc-loaded waveguide in a strong axial magnetic field. The resulting cubic dispersion relation yields instability growth rates and frequencies which fall off beyond their maxima more sharply with increasing wavenumber than for the complete dispersion relation. However, the approximation is found to be quite good near the operating points of contemporary high-power relativistic backward-wave oscillators, namely, for relatively long wavelength and small ratio of Bjudker's parameter to the relativistic gamma factor of the beam.

46123 Nonlinear space-charge waves on an intense relativistic electron beam. (Plasma Physics Div., Naval Research Lab., Washington, DC (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 249-257(Apr 1988).

The propagation characteristics of the large-amplitude space-charge waves on a modulated intense relativistic electron beam are calculated. It is shown that the slow space-charge waves may cease to propagate if the modulating voltage is sufficiently high, whereas the fast waves are relatively unaffected by the nonlinearity. The limiting electron velocity inferred from the analytical theory is in

excellent agreement with particle simulation. The implications are discussed.

46124 3D bounce averaged Fokker-Planck calculation of electron cyclotron current drive efficiency. Harvey, R.W.; McCoy, M.G.; Kerbel, G.D. (GA Technologies Inc., San Diego, CA 92138). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 49-52(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

Electron cyclotron current drive heating efficiency in tokamak is calculated using 3D bounce averaged Fokker-Planck equation. A computer code has been assembled which predicts the profiles of heating and current drive. (AIP)

46125 Ion Bernstein wave heating experiments on Alcator C. Moody, J.D.; Porkolab, M.; Fiore, C.L.; McDermott, F.S.; Takase, Y.; Terry, J.; Wolfe, S.M. (Plasma Fusion Center, M.I.T., Cambridge, MA 02139). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 326-330(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

ICRF ion Bernstein wave heating has been studied on the Alcator C tokamak in both the hydrogen 3/2 (B = 7.6T) and deuterium 5/2(B = 9.3T, $\omega = 3\omega$/sub c//sub D/ at the plasma edge, x/a≈0.87) subharmonic regimes. Rf power of up to 180 kW at 183.6 MHz was coupled into the plasma for up to 150 ms using a toroidal current loop with a loading resistance between 1 and 2Ω. Ion heating effieciencies, n-bar/sub e/ΔT/sub i//P/sub r//sub f/, of up to 5.5 eV m^{-3}/kW at B = 9.3T and 2.5 eV m^{-3}/kW at B = 7.6T at n-bar/sub e//sub (Oh)/ = 0.8 x 10^{20} m^{-3} were observed. A two temperature minority (deuterium) (T/sub D/<2000eV for n/sub D//n/sub H//sub +//sub D/<20%) ion distribution as well as improvements by a factor of 2—3 in global particle confinement and central impurity confinement times are observed in both cases. The energy confinement time, tau/sub E/, increased from 5 ms to 7.7 ms with an average incremental confinement time, ΔW/sub total//ΔP/sub total/, of 11 ms for the 9.3T case. For the B = 7.6T case, tau/sub E/ changed from 5 ms (Ohmic) to between 3 ms and 8 ms. At higher densities, n-bar/sub e/>2 x 10^{20} m^{-3}, the heating becomes inefficient.

46126 Edge measurements during ICRF heating in PLT. Lehrman, I.S.; Colestock, P.L.; Greene, G.J.; McNeill, D.H.; Ono, M.; Wilson, J.R.; Manos, D.M.; Bernabei, S.; Shohet, J.L. (Princeton Plasma Physics Lab., Princeton, NJ 08544). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 274-277(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

Measurements of plasma parameters in the edge region of PLT during ICRF heating experiments have been performed in an attempt to ascertain the relevant processes at work in coupling RF power to a hot, dense plasma and to understand how these processes limit the power handling capability of ICRF antennas. Langmuir douple probe measurements of edge electron temperature and density were made along with a calorimeter probe to measure particle heat flux along field lines. In addition, spectroscopic observations of neutral deuterium (D/sub α/), CIII, and CrI were made at various points around the torus.

46127 Coherence limited resonant diffusion. Kerbel, G.D. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 430-433(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

A description of wavepacket driven, collision limited resonant diffusion in tokamaks can be represented mathematically through the use of phase diffusion kernel in the trajectory integral. A new technique has been implemented which allows the global development of numerical representations of these integrals as the solutions of a certain partial differential equation whose initial and boundary data derive from an asymptotic analysis of the fully coherent system.

46128 Ray tracing analysis of LH fast waves in CCT. Mau, T.K.; Lai, K.F.; Taylor, R.J. (University of California, Los Angeles, CA 90024). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 207-210(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

Lower hybrid fast wave field profiles have been measured in the CCT tokamak. These field maps exhibit characteristics of large n/sub ///sub // wave components, with n/sub perpendicular//n/sub ///sub //≈1, and the wave energy appears to be heavily damped in the toroidal direction. We use a 3-D toroidal ray tracing code to study this wave behavior. The spectral filtering of the fast wave can be partially attributed to mode conversion to the slow wave for the low n/sub ///sub // components. In most parameter regimes, subsequent strong absorption of the converted slow wave via electron Landau and higher harmonic ion damping results.

46129 Control of fast magnetostatic modes with a phased antenna array in the Phaedrus-B tandem mirror. Majeski, R.; Browning, J.J.; Hershkowitz, N.; Meassick, S.; Ferron, J. (University of Wisconsin, Madison, WI 53706). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 250-253(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

The central cell of the Phaedrus-B tandem mirror is equipped with four dual half-turn ICRF antennas. The antennas are arranged in two close-spaced pairs, with the antenna pairs located 50 cm to either side of central cell midplane. In these experiments, two antennas (one from each pair) with an axial separation of 1 m are driven by separate RF amplifiers, each with >200 KW power output. The relative phase of the driven antenna currents may be fixed throughout a shot, or rapidly swept (180° in <100 μsec). We demonstrate that the relative antenna phasing can be used to control excitation of the m = +1 fast magnetosonic wave in Phaedrus, by tailoring the k/sub parallel/ spectrum of the antenna set. We further show that strong excitation of the m = +1 fast magnetosonic eigenmode provides stabilization against the curvature driven flute instability through pondermotive force effects. Conversely, when the antenna phasing is chosen to suppress the m = +1 fast magnetosonic eigenmode, the plasma is MHD unstable, with density fluctuation levels on the order of δn/n = 1. Results are in good agreement with predictions from the ICRF code ANTENA of Brian McVey.

46130 Coupling of an ICRF compact loop antenna to H-mode plasmas in DIII-D. Mayberry, M.J.; Baity, F.W.; Hoffman, D.J.; Luxon, J.L.; Owens, T.L.; Prater, R. (G.A. Technologies, Inc., San Diego, CA 92138). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 278-281(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

Low power coupling tests have been carried out with a prototype ICRF compact loop antenna on the DIII-D tokamak. During neutral-beam-heated L-mode discharges the antenna loading is typically R≈1-2Ω for an rf frequency of 32 MHz (B/sub T/ = 21 kG, $\omega = 2\Omega$/sub D/(0)). When a transition into the H-mode regime of improved confinement occurs, the loading drops to R≈0.5-1.0Ω. During ELMs, transient increases in loading up to several Ohms are observed. The apparent sensitivity of ICRF antenna coupling to changes in the edge plasma profiles associated with the H-mode regime could have important implications for the design of future high power systems.

46131 Numerical simulation of the laser-sustained plasma thruster. Jeng, S.M.; Keefer, D. (Center for Laser Applications, Univ. of Tennessee Space Institute, Tullahoma, TN (US)). pp 1829-1832 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

A numerical code has been successfully developed for the investigation of thruster performance using a laser-sustained hydrogen plasma as the propellant. The plasma was sustained using a 10.6μm CO/sub 2/ laser beam which is focused at different positions within the thruster. The physical model, which has been verified for forced convective laser-sustained argon plasma flows, assumed that the plasma is in thermodynamically equilibrium (LTE), and geometric ray tracing was adopted to describe the focusing of the laser beam. The steady-state, axisymmetric, Navier-Stokes equations coupled with the laser power absorption process have been solved numerically. A pressure based Navier-Stokes numerical solver using body-fitted coordinates was used to calculate the laser heated rocket flow which includes both subsonic and supersonic flow regions. From the limited parametric study, which did not try to optimize the rocket performance, it was found that much better vacuum specific impulse, compared to a traditional chemical rocket, is obtained using the laser-sustained plasma thruster.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 44784, 44786, 45037, 45037, 45117, 45509, 45511, 45724, 45841, 45941, 45942, 46058, 46079, 46082, 46115, 46122, 46123

46132 (ANL/FPP—88-1) ITER [International Thermonuclear Experimental Reactor] shield and blanket work package report. (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88012661/JAW.

This report summarizes nuclear-related work in support of the US effort for the International Thermonuclear Experimental Reactor (ITER) Study. The purpose of this work was to prepare for the first international ITER workshop devoted to defining a basic ITER concept that will serve as a basis for an indepth conceptual design activity over the next 2-1/2 years. Primary tasks carried out during the past year included: design improvements of the inboard shield developed for the TIBER concept, scoping studies of a variety of tritium breeding blanket options, development of necessary design guidelines and evaluation criteria for the blanket options, further safety considerations related to nuclear components and issues regarding structural materials for an ITER device. 44 refs., 31 figs., 29 tabs.

46133 (ANL/FPP/TM—218) Summary of mechanical properties data and correlations for Li_2O, Li_4SiO_4, $LiAlO_2$, and Be. Billone, M.C.; Grayhack, W.T. (Argonne National Lab., IL (USA). Fusion Power Program). Apr 1988. Contract W-31109-ENG-38. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013794/JAW.

The data base for thermal expansion, elastic constants, compressive and tensile failure strengths and secondary thermal creep of leading solid-breeder (Li_2O, Li_4SiO_4, and $LiAlO_2$) and multiplier (Be) materials is reviewed, porosity, grain size, and stress (for thermal creep). Because the data base is rather sparse in some areas, general properties of ceramics and metals are used to help guide the formulation of the correlations. The primary purpose of the data base summary and correlation development is to pave the way for stress analysis sensitivity studies. These studies will help determine which properties are important enough to structural lifetime and deformation assessments to require more data. 18 refs., 5 figs., 20 tabs.

46134 (CFFTP-B—86002) Irradiation of lithium-based ceramics for fusion blanket application. Hastings, I.J.; Miller, J.M.; Verrall, R.A.; Bokwa, S.R.; Rose, D.H. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jun 1986. 25p. (AECL—9187; CONF-860613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703110/JAW.

From 26. annual international conference of the Canadian Nuclear Association and the 7. annual conference of the Canadian Nuclear Society; Toronto, Ontario, Canada (8 Jun 1986).

Unvented CREATE (Chalk River Experiment to Assess Tritium Emission) tests have shown that under reducing conditions, most of the tritium (greater than 70%) is released from LiAlO/sub 2/ and Li/sub 2/O as HT or T/sub 2/; the balance as HTO or T/sub 2/O. Residual tritium is very small, less than 0.02%. Varying the sweep gas composition has a dramatic effect on the form of tritium released. With a quartz extraction tube during post- irradiation heating, a He sweep gas results in 10-30% release as HT or T/sub 2/; with a He-1%H/sub 2/ sweep gas, greater than 60% release as HT is achieved. The effect of extraction tube material is also significant. Using pure He sweep gas, a quartz extraction tube results in 10-30% release as HT or T/sub 2/; stainless steel produces 80-95% as HT or T/sub 2/. Chalk River and CEA (Saclay) - fabricated LiAlO/sub 2/ behaved similarly to that from ANL in these tests. The first vented test at Chalk River, CRITIC-I, planned for 1986/87, will examine ANL-fabricated Li/sub 2/O, 0.3 wt% /sup 6/Li, 30 mm ID, 40 mm OD annular pellets, in a six-month irradiation at 700-1200 K, varying the sweep gas, with on-line HT/HTO measurement.

46135 (CONF-8806170—2) A study of the factors effecting the deposition of smooth plasma polymers. Crawley, R.L.; Daukas, J.C.; Murrell, S.R. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC08-87DP10560. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013019/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

We have been working to develop smooth CH coatings on glass and polymer spherical fuel capsules. Last year we were requested to dramatically improve the surface finish of the glow discharge polymer (GDP) coatings. This report summarizes the development carried out to accomplish this task and the results obtained along the way. 4 refs., 8 figs.

46136 (ENEA-RT-FUS—87-28) FTU (Frascati Tokamak Upgrade) vacuum chamber. Cecchini, A.; Gasparotto, M.; Pizzuto, A.; Rigadello, A.; Toldo, G. (ENEA, Rome (Italy)). 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702848/JAW.

The FTU vacuum vessel has been designed to withstand high electromagnetic and thermal loads and to reach high vacuum conditions which are essential to obtain clean, impurity free plasma. After a survey of the vacuum chamber requirements and of the design development, the paper reports the main manufactoring process such as welding, stress relieving, machining, nondestructive testing, outgassing and preassembly.

46137 (GA-A—19295) Reduction of recycling in DIII-D by degassing and conditioning of the graphite tiles. Jackson, G.L.; Taylor, T.S.; Allen, S.L.; Ferron, J.; Haas, G.; Hill, D.; Mahdavi, M.A.; Nakamura, H.; Osborne, T.H.; Petersen, P.I. (General Atomic Co., San Diego, CA (USA)). May 1988. Contract AC03-84ER51044;W-7405-ENG-48. 23p. (CONF-880512—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012816/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

Reduced recycling, reduced edge neutral pressure, improved density control, and improved discharge reproducibility have been achieved in the DIII-D tokamak by in situ helium conditioning of the graphite tiles. An improvement in energy confinement has been observed in hydrogen discharges with hydrogen beam injection after helium preconditioning. After the graphite wall coverage in DIII-D was increased to 40%, helium glow wall conditioning, routinely applied before each tokamak discharge, has been necessary to reduce recycling and obtain H-mode. The utilization of helium glow wall conditioning was an important factor in the achievement of an ohmic H-mode, i.e. no auxillary heating, with significant improvement in ohmic energy confinement. 16 refs., 8 figs.

46138 (IAEA-TECDOC—440) Fusion reactor safety. Report of a technical committee meeting held in Culham, 3-7 November 1986. (International Atomic Energy Agency, Vienna (Austria)). Dec 1987. 367p. (CONF-861143—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW.

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Nuclear fusion could soon become a viable energy source. Work in plasma physics, fusion technology and fusion safety is progressing rapidly in a number of Member States and international collaboration continues on work aiming at the demonstration of fusion power generation. Safety of fusion reactors and technological and radiological aspects of waste management are important aspects in the development and design of fusion machines. In order to provide an international forum to review and discuss the status and the progress made since 1983 in programmes related to operational safety aspects of fusion reactors, their waste management and decommissioning concepts, the IAEA had organized the Technical Committee on "Fusion Reactor Safety" in Culham, 3-7 November 1986. All presentations of this meeting were divided into four sessions: 1. Statements on National-International Fusion Safety Programmes (5 papers); 2. Operation and System Safety (15 papers); 3. Waste Management and Decommissioning (5 papers); 4. Environmental Impacts (6 papers). A separate abstract was prepared for each of these 31 papers. Refs, figs, tabs.

46139 (IAEA-TECDOC—440, pp 31-38) **European R and D activities in the field of fusion safety.** Gulden, W. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The paper outlines requirements to be met by the "Next European Torus" (NET), European contributions to fusion safety, programme structure and working areas, activities, studies and tasks to be performed. Overview time schedules for programme implementation are given. (author). 2 tabs, 2 figs.

46140 (IAEA-TECDOC—440, pp 39-45) **Overview of the US magnetic fusion safety program.** Haas, G.M.; Nardella, G.R. (USDOE Office of Fusion Energy, Germantown, MD (USA). Div. of Development and Technology). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The paper outlines objectives set, the strategy adopted for fusion development and the role of the US fusion safety programme. The various research areas under this programme and studies in support of this programme are presented.

46141 (IAEA-TECDOC—440, pp 47-62) **Preliminary findings of a US National Committee on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy.** Holdren, J.P. (California Univ., Berkeley (USA)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The Senior Committee on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy (ESECOM) was organized by the Lawrence Livermore National Laboratory at the request of the Office of Fusion Energy of the U.S. Department of Energy to examine the interaction of environmental, safety, and economic characteristics in fusion-reactor design. The committee has been addressing the following questions: (1) What will be the likely economic, environmental, and safety characteristics of magnetic-fusion reactors assuming these are based on the D-T fuel cycle, present "mainline" confinement schemes and engineering designs, present "mainline" candidate materials, and extrapolation (to the fusion case) of construction practices from the fission power industry? (2) What is the potential for improving performance with respect to economics, or environment, or safety, or (most significantly) the combination of these achievable in a single design, through alternative materials, alternative blanket designs, alternative energy-conversion schemes and outputs, alternative confinement schemes, alternative fuel cycles, and alternative balance-of-plant designs and construction practices made possible by such innovations? (3) What changes in present programs of fusion R and D might increase the probability of achieving such improvements? (4) How does the potential of fusion in these respects compare to that of its likely competitors? (author).

46142 (IAEA-TECDOC—440, pp 63-72) **Tritium safety programme at JET.** Gordon, C.W. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Work underway to ensure safe methods of working with tritium are implemented and to obtain the necessary approvals and authorisations before tritium arrives on site is described. The information and analyses are discussed under four broad categories: (a) routine tritium releases to the environment; (b) occupational exposures; (c) accidental releases; and (d) waste handling. A programme has been developed to ensure that all safety issues are adequately addressed at appropriate times during the design, manufacture, installation, commissioning and operation of the tritium plant. (author). 3 refs, 2 tabs.

46143 (IAEA-TECDOC—440, pp 93-102) **Lessons learned from the reliability analysis of the personnel safety and access control system of a tokamak fusion experiment.** Campbell, H.E.; Cowie, H. (UKAEA Safety and Reliability Directorate, Culcheth). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Pulsed Tokamak experiments give rise to significant direct radiation even in the pre-tritium phase. A fundamental safety requirement is the provision of high integrity personnel access control systems to protect site, operational staff and the public from the risk of exposure to high radiation. The paper discusses the radiation hazards during the early hydrogen/deuterium operation and the different levels of installed safeguards which included diverse safety systems in the form of conventional hard wired interlocking and programable logic controllers. The form of a detailed reliability analysis assessing the risk of individual exposure to high radiation (for both the public off-site and staff on-site) is discussed together with the lessons learnt and some of the design changes implemented. An interesting feature is the impact of human reliability in the analysis and how a recently developed technique (HEART) provided an estimation of error rates. The confidence gained in addressing the reliability of personnel and public protection against radiation hazards under normal operating conditions provides an important foundation for the safety analysis of fusion plant with significant tritium inventory. (author). 4 refs, 2 figs, 1 tab.

46144 (IAEA-TECDOC—440, pp 103-112) **Safety scenario for fusion experimental reactor (FER).** Seki, Y.; Iida, H.; Honda, T.; Aizawa, K. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment; Toshiba Corp., Tokyo (Japan); Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

A scenario to ensure the safety of the Fusion Experimental Reactor (FER) is proposed. The safety features of a fusion reactor are given and their impacts on the safety design are shown. The requirements in the design of major components of FER to achieve safety and the safety evaluation process are described. The results of the evaluation showed that even in the event of the maximum credible accidents, the radiological consequence to the public can be held at an acceptable level. The applicability to FER of various aspects of the regulations for facilities treating large amounts of radioisotopes is discussed with a positive conclusion. (author). 11 refs, 1 fig.

46145 (IAEA-TECDOC—440, pp 133-143) **Safety evaluation of the R-Tokamak.** Fujii-e, Y.; Kozawa, Y.; Nishikawa, M.; Yano, T.; Yanagisawa, I.; Kotake, S.; Sawada, T. (Tokyo Inst. of Tech. (Japan); Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan); Mitsubishi Research Inst., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The safety evaluation of the R-tokamak was carried out by applying the "safety analysis and evaluation methodology". The purpose of this evaluation is to confirm the validity and usefulness of the methodology. The following results were obtained: (1) Safety characteristics of the R-tokamak design was clarified. In this process, the General Descriptive Model for the R-tokamak was constructed. (2) Design Basis Events for the R-tokamak were selected based on the function based safety analysis and they were classified according to the event categorization. Safety functions were investigated in relation with the DBEs. In results, the validity and effectiveness of our methodology were confirmed. (3) Tritium release to the environment was analysed using the containment system model with the tritium cleanup system. The result showed that the amount of released tritium was small (less than 2 Ci), and the pressure increase in the containment had a key effect on the tritium release to the environment. (author). 4 refs, 4 figs, 5 tabs.

46146 (IAEA-TECDOC—440, pp 145-154) **Safety analysis and evaluation methodology for fusion systems.** Fujii-e, Y.; Kozawa, Y.; Nishikawa, M.; Yano, T.; Yanagisawa, I.; Kotake, S.; Sawada, T. (Tokyo Inst. of Tech. (Japan); Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan); Mitsubishi Research Inst., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

A synthesized methodology of safety analysis and evaluation for general fusion systems is proposed. In the course of the methodology development, its main frame has been constructed in order to take account of all safety-related items and to ensure a logical consistency. The safety-related items are divided broadly into two groups. One of them is the public protection from radiological hazard, which is introduced as a safety requirement from an external viewpoint for the fusion system. The other items are the matter from an internal viewpoint and are related to the fusion system behavior in itself. These items are composed of the understanding of a fusion system, the safety ensuring principle and the function based safety analysis. All of these items have been mapped on the frame, considering the mutual relations, among them, consistently. To complete the methodology development, the safety evaluation for the actual design of a fusion system has been performed in conformity to this methodology. Thus, it has been demonstrated that the methodology proposed here is appropriate to the safety analysis and evaluation for the fusion system. (author). 9 refs, 4 figs, 2 tabs.

46147 (IAEA-TECDOC—440, pp 155-156) **Function based safety analysis on fusion systems.** Fujii-e, Y.; Kozawa, Y.; Nishikawa, M.; Yano, T.; Yanagisawa, I.; Kotake, S.; Sawada, T. (Tokyo Inst. of Tech. (Japan); Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan); Mitsubishi Research Inst., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

A function based safety analysis was carried out to understand the system behavior of fusion systems in the abnormal conditions and to investigate the Design Basis Events (DBEs) and safety functions for general fusion systems. The General Descriptive Model (GDM) was used in the analysis. The GDM is a system model for general fusion systems and is composed of several system elements, where each system element is a set of functions, areas and boundaries. Typical events could be summarized in a small number, 16, by focusing on the abnormal events in each system element of the GDM. For investigating DBEs and safety functions, event sequences were constructed by regarding the typical event as the initiating event. A sequence was terminated if the probability of occurrence became less than the value, i.e. 10/sup -6/. Finally, DBEs for general fusion systems, which envelop all credible events important to safety, were summarized as 20 events. (author). 2 refs, 4 figs, 3 tabs.

46148 (IAEA-TECDOC—440, pp 167-176) **Safety ensuring principle for fusion studies.** Fujii-e, Y.; Kozawa, Y.; Nishikawa, M.; Yano, T.; Yanagisawa, I.; Kotake, S.; Sawada, T. (Tokyo Inst. of Tech. (Japan); Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan); Mitsubishi Research Inst., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

In order to ensure safety of a fusion system, it is required that the amount of radioactivity released to the environment should be controlled below an acceptable limit under any circumstances. This safety requirement can be satisfied by realizing adequate safety protections into the fusion system. The safety ensuring principle, which is a guideline to endow the fusion system with such adequate safety protections, has three aspects: what should be protected under normal and off-normal conditions; how the safety protections can be realized; and what level of assurance should be required to the safety protections. Here the defense-in-depth principle, the advantage of inherent and passive safety features, and risk consideration are taken into account. Through the examination of RI leak structure, three principal items to be protected are obtained: (1) RI controllability, (2) boundary integrity and (3) containment integrity. To materialize the safety protections under these items, an approach is proposed to prioritize safety features: inherent, passive and active safety features. Also an approach to safety assurance and evaluation is proposed to realize just enough level of the safety protections, which includes an event categorization with the risk consideration. (author). 2 refs, 3 figs, 5 tabs.

46149 (IAEA-TECDOC—440, pp 177-184) **Computer codes for safety analysis.** Holland, D.F. (Idaho National Engineering Lab., Idaho Falls (USA)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Because of the complexity of fusion facilities, computer calculated predictions will be required for safety analysis. Although many sophisticated codes are available, several features of fusion test facilities and commercial power plants are unique and consequently new codes must be developed. The Fusion Safety Program at the Idaho National Engineering Laboratory has initiated development of a number of computer codes to analyze fusion safety concerns. The Tritium Migration Analysis Program (TMAP) is capable of modeling tritium implantation and permeation in solids as well as chemical reactions involving tritium. The code can model tritium movement within the reactor system. Another code, LITFIRE, has been developed to predict the consequences of a lithium fire inside a reactor building. The code performs a self-consistent calculation to determine chemical reactions, temperatures, and pressures. Because of the complexity of heating and cooling systems in a fusion facility, the transient analysis code ATHENA was developed to perform thermal hydraulic calculations of a system with multiple fluid loops with different fluids. The code can model fusion energy sources, two-phase flow, and MHD effects. The DSTAR code is used to model the evolution and consequences of plasma disruptions. A self-consistent solution is required involving the plasma, magnetic fields, and the material from the limiter. To determine consequences of accidental release of electromagnetic energy, the MSCAP code was developed for safety analysis of magnets. The code models both the magnet and the associated electrical circuit to determine the consequences of such off-normal events and arcs and shorts. The code capabilities discussed are complete but additional development is continuing to enhance the codes and also verify the calculations by comparison with experimental measurements. (Abstract Truncated)

46150 (IAEA-TECDOC—440, pp 205-212) **Inherent/passive safety in fusion power plants.** Piet, S.J.; Crocker, J.G. (Idaho National Engineering Lab., Idaho Falls (USA)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The concept of inherent or passive safety for fusion energy is explored, defined, and partially quantified. Four levels of safety assurance are defined, which range from true inherent safety to passive safety to protection via active engineered safeguard systems. Fusion has the clear potential for achieving inherent or passive safety, which should be an objective of fusion research and design. Proper material choice might lead to both inherent/passive safety and high mass power density, improving both safety and economics. When inherent or passive safety is accomplished, fusion will be well on the way to achieving its ultimate potential and to be a truly superior energy source for the future. (author). 9 refs, 2 figs.

46151 (IAEA-TECDOC—440, pp 213-226) **Cost-benefit approach to safety consideration.** Kazimi, M.S.; Brereton, S. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

A discussion of the use of cost-benefit analysis is provided and an approach proposed for application to fusion reactor design considerations. Advantages and disadvantages of this method are outlined. An assessment is given of the cost effectiveness of emergency detritiation systems for INTOR. (author). 25 refs, 2 figs, 3 tabs.

46152 (IAEA-TECDOC—440, pp 281-289) **Preparations for the decommissioning of JET.** Hancox, R. (Euratom/UKAEA Fusion Association, Abingdon (UK)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The Joint European Torus (JET), designed for operation with DT fuel, is the largest fusion experiment in Europe. Established in 1978, it will have to be decommissioned after the year 1992. The paper describes the experiment, expected radioactivity contents, decommissioning tasks and preparations for decommissioning. (author). 5 refs, 2 figs, 2 tabs.

46153 (IAEA-TECDOC—440, pp 113-121) **Transient analysis of the water-cooled eutectic LiPb blanket of NET.** Klippel, H.T. (Netherlands Energy Research Foundation, Petten). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

For the liquid LiPb blanket concept of NET the response of the first wall and the water cooled blanket to coolant tube blockage, loss of pumping power and coolant tube break events has been evaluated. Thermal-hydraulic calculations were carried out with the code RELAP followed by 2- and 3-dimensional transient non-linear heat transfer calculations with the code MARC. The main conclusion is that the concept of two parallel coolant loops provides a good safety measure since a flow coastdown in one coolant loop while the plasma is still burning does not lead to any significant temperature increase of the structures. Also passive shutdown cooling by natural convection flow or thermal radiation is sufficiently adequate to remove the decay heat in first wall and blanket. (author). 7 refs, 11 figs, 3 tabs.

46154 (IAEA-TECDOC—440, pp 123-132) **Fusion reactor blanket and first wall risk analysis.** Djerassi, H.; Rouillard, J. (CEA, Institut de Protection et de Surete Nucleaire, Gif-sur-Yvette (France). Dept. de Protection Technique). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

One of the important safety issues of a fusion reactor is the behaviour of the blanket and the first wall on accidental conditions. The first choice of blanket for NET (Next European Torus) is an integrated first wall-blanket segment design with Li/sup 17/Pb/sup 83/ as breeder, cooled by pressurized water. Starting from this option, a methodology of safety analysis is defined, in order to be able to point out weak points of this design and to emphasize recommendations capable to increase safety. Possible initiating events are identified and the most dangerous is studied (loss of coolant inside blanket module or inside first wall). The data bases of failure rate from French facilities statistical studies (PWR and LMFBR) are adapted to specific fusion reactor problems (LiPb corrosion, cycling working of fusion reactor and irradiation induced damage influence). Event trees for blanket, first wall and overall segment are built up and calculated. The risks, i.e. occurrence probability time detriments, are analyzed on three points of view: machine damages, occupational hazards and environmental impact. On the machine consequences four levels are identified. From last level, machine damages may be considered very important: possible ingress of torus chamber by LiPb and water, etc... (overall probability occurrence of about 5 E-4 a year). Finally, the event tree after segment failure is developed and it points out that hall contamination may be very large (up to 1.5Kg of activated erosion dust, about 10g of tritium and volatile activated products coming from the breeder). Probability of such contamination is of the order of E-4 a year. Nevertheless, if occupational impact may be severe, it has been found that environment impact can be maintained to a level rather low (2 mRem for the M.E.I.) as far as the last barrier (wall of the reactor building) withstands. (author). 6 refs, 6 figs, 3 tabs.

46155 (IAEA-TECDOC—440, pp 185-202) **Methodological safety analysis for NET accident scenarios.** Sarto, S.; Cambi, G.; Zappellini, G. (ENEA, Rome (Italy); Bologna Univ. (Italy); NIER Coop., Bologna (Italy)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

In the frame of the CEC/ENEA Association Contract for Fusion Activities a systematic technique of analysis is applied to the "First Wall and Liquid Lithium - Lead Blanket System" of the NET plant for the accident scenarios identification. A rough qualitative and quantitative iteration of the analysis has been performed, so that to put in evidence its possible and more interesting outputs for the plant designers. The main results of the work are described in this paper. (author). 2 refs.

46156 (IAEA-TECDOC—440, pp 203) **Afterheat assessment for conceptual tokamak reactors.** Goddard, A.J.H.; Jayatissa, S. (Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Afterheat represents an important consideration in design of conceptual fusion power reactors, particularly during normal or unplanned shutdown. Afterheat calculations have been undertaken for various generic designs, but with special reference to the Culham DEMO reactor. These calculations have included the redistribution of heating by gamma ray transport. Selected temperature response calculations have been undertaken.

46157 (IAEA-TECDOC—440, pp 75-82) **Tritium processing laboratory for the fusion research program at JAERI.** Yoshida, H.; Naruse, Y.; Matsuda, Y.; Konishi, S. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The paper outlines the following: 1. General National Program in Japanese Fusion Research; National Organization, JAERI Organization. 2. JAERI's program on tritium technology and safety for the next D-T burning device. 3. Brief description of the TPL in

JAERI; Objects and schedule, research items, design criteria on tritium confinement, functions of safety systems, accident scenarios, simulation analysis on TPL safety, environmental impacts.

46158 (IAEA-TECDOC—440, pp 83-92) **Present status of tritium monitoring and related studies at JAERI.** Noguchi, H.; Akaishi, J.; Yamamoto, H.; Kato, S.; Murata, M.; Yoshida, Y. (Japan Atomic Energy Research Inst., Ibaraki (Japan). Dept. of Health Physics). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Tritium monitoring systems have been developed for the tritium handling facilities in JAERI. In the Fusion Neutronics Source Facility, tritium of 1000 Ci is handled as a metal target. In the Tritium Process Laboratory, it is planned to start handling tritium of 10/sup 5/ Ci at the beginning of 1988. Tritium concentrations in rooms of the facilities are monitored with 30-liter ionization chambers. Ionization chambers with gamma compensation to reduce gamma effect are installed to monitor tritium concentrations in the stacks. Tritium gas (HT) and tritiated water (HTO) discriminating samplers are also installed together with the stack monitors to measure the quantities of HT and HTO released from the stacks. Tritium concentrations in the following environmental samples are routinely monitored in JAERI: sea water, river water, drinking water, rain water, air and vegetation such as pine needles. The following studies for tritium safety have been made in the Department of Health Physics: measurement of permeabilities of elastomeric and polymeric films to HTO vapor and measurement of distributions of tritium concentrations in concrete walls and floor of JRR-3 (heavy water moderated research reactor). The conversion of tritium gas (T/sub 2/) to tritiated water was studied experimentally in the cooperation with Oak Ridge National Laboratory. (author). 13 refs, 6 figs, 2 tabs.

46159 (IAEA-TECDOC—440, pp 293-302) **Role of containment systems for fusion systems safety.** Fujii-e, Y.; Namba, C.; Suzuki, T.; Mizushina, T. (Tokyo Inst. of Tech. (Japan); Nagoya Univ. (Japan); Taisei Corp., Tokyo (Japan)). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Containment systems for fusion systems are investigated as a practical choice to provide safety features to achieve physical separation, and as an application of the "defence-in-depth principle". Here, the role of containment systems is discussed and the constitution which is necessary to achieve the role is investigated on the basis of the characteristics of fusion systems. The following results are obtained: (1) Necessary containment boundaries and functions are extracted from the analysis of fusion systems. (2) Partial containment systems are recommended for fusion systems by understanding RI release modes which are postulated in a containment area. (author). 2 refs, 3 figs, 2 tabs.

46160 (IAEA-TECDOC—440, pp 327-336) **Radioactive emissions and environmental effects of fusion reactors.** Rocco, P. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The results of recent environmental studies on magnetic D-T fusion are presented. The routine emissions of FCTR, a tokamak power reactor with characteristics extrapolated from those of NET and INTOR, have been evaluated with conservative hypotheses. They produce very low effects in the environment and these can be further reduced on the basis of a cost-benefit analysis. Reference releases are defined for extreme accident conditions. Their environmental effects outside the plant area do not reach the limits necessitating evacuation. (author). 19 refs, 3 tabs.

46161 (IAEA-TECDOC—440, pp 257-270) **Recycling of activated steel first wall/blanket materials from fusion reactors.** Butterworth, G.J.; Gomer, C.R.; Tupholme, K.W.; Dulieu, D. (Euratom/UKAEA Fusion Association, Abingdon (UK); British Steel Corp., Rotherham. Swinden Labs.). Dec 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88702856/JAW. (CONF-861143—).

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Process routes are outlined for conversion of active reactor steel scrap to feedstock for the production of new components, with the requirement that the amount of activity leaving the fusion system be minimised. The proposed route comprises vacuum induction melting followed by continuous casting or powder production and compaction using isostatic techniques. It is considered that reprocessing is feasible provided the contact dose rate of the material is below 25mSvh/sup -1/. A storage time of about 70y would be required for low-activation steels of currently anticipated compositions to attain this value. Potentially active wastes will be generated at all stages, some of these can be recycled to the melting unit whilst others will require disposal. The fraction of the initial radioactivity retained in the recycled material varies from about 80 to 95%, depending on the starting composition and the extent to which transmutation-induced changes may need to be compensated during remelting. (author). 1 ref., 5 figs, 4 tabs.

46162 (KMSF-U—1981) **Fabrication of macroshell targets for beta-heating experiments.** Scott, L.A.; Martin, A.J.; Butkiewicz, D.A. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC08-87DP10560. 9p. (CONF-8806170—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013013/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

We are investigating methods of producing and characterizing large diameter, thin-walled glass capsules for Inertial Fusion (IF) experiments. Dimensional requirements for the capsules specify diameters of two to ten millimeters and a wide range of aspect ratios (diameter/wall). These shells are larger in diameter than shells made in drop towers. Because of their larger size and different fabrication technology, they have been given the designation, macroshell. Glass macroshell targets are transparent, seamless, fuel containers which are currently used in beta-heating experiments at KMSF. The capsules are also potentially useful for neutron production experiments with IF drivers like Nova. The technology developed to fabricate these fuel containers may be useful in the fabrication of polymer shells necessary for the proposed Laboratory Microfusion Facility (LMF); some work with polymers has started. 6 refs., 2 figs., 2 tabs.

46163 (KMSF-U—1985) **The fabrication of "Gaussian bumps" on small spherical substrates.** Murrell, S.R.; DeMaggio, G.B.; Lintz, H.K.; Ruppe, J.A.; Soltis, A.R.; Daukas, J.C. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC08-87DP10560. 9p. (CONF-8806170—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013014/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

The objective of the reported work was to fabricate hollow microsphere targets containing well known wall non-uniformities and surface defects. These targets will be used to study the influence of known perturbations on implosion dynamics. The geometric characteristics were chosen such that the perturbation cross section is described by a Gaussian curve with a well defined height and full width half maximum (FWHM). Perturbations were to consist of both low-Z polymer (polystyrene) and Mid-Z material (aluminum). The application of the polystyrene bumps was accomplished by melting polystyrene beads onto the GDP coated surface of polymer targets. This report, however, limits the discussion to the preliminary studies for fabricating aluminum "Gaussian bumps" on glass microshell targets by means of evaporation through a pinhole aperture. Also discussed is a model developed in parallel which helped us to better understand the bump formation process and to optimize the deposition parameters.

46164 (KMSF-U—1992) Beta heating driven DT-ice redistribution: Multidimensional heat and mass transfer. Martin, A.J.; Simms, R.J.; Wineberg, S.B. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC08-87DP10560. 9p. (CONF-8806170—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013759/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

DT-ice redistribution is a mass transfer phenomenon that is energy transfer driven. The β-energy from the radioactive decay of tritium is deposited in the target, primarily in the DT-ice. This energy escapes by several means: sublimation/condensation associated with DT-ice redistribution; thermal conduction through the ice; and thermal conduction through the target wall to the enclosure. Mathematically, the most general problem involves a coupled set of fluid and heat flow equations, which model heat transfer via conduction and convection, and mass redistribution in the ice layer. This model has a moving internal boundary--the vapor ice interface. Our primary interests are how this vapor/ice interface varies with time and what will be the final ice distribution. We account for mass transport by altering conductivity coefficients to include corrective heat transfer, and by calculating a time-varying ice/vapor interface. This removes the fluid flow equations from the system, leaving a time dependent, multidimensional, nonlinear heat equation to be solved. For the numerical computations, a 2-d code called PLTMG was used.

46165 (KMSF-U—1996) KCl bounce coating of glass and polymer microshells. DeMaggio, G.B.; Murrell, S.R.; Lintz, H.K.; Daukas, J.C. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC08-87DP10560. 11p. (CONF-8806170—9). NTIS, PC A03. Order Number DE88013018/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

The progress that the Inertial Confinement Fusion (ICF) program has seen with increased laser energy and advances in plasma theory has pushed for improvements and advances in both target performance diagnostics and target fabrication. Many advances in target hinge on the ability to prepare implosion pellets with a high degree of sphericity and then overcoat these with thin films of many different materials. The materials desired by the experimenters are quite varied and the requirements for smoothness and uniformity of these coatings are becoming more stringent. This summary describes work we are pursuing at KMS concerning the preparation of spherical targets with imbedded layers to aid in the evaluation of the implosion process. These layers contain specific elements designed to absorb x-rays and yield an image of the compressed target. In this case, chlorine is the required element; and on chemically stable form in which to include this element is KCl. The complete target requires a thick hydrocarbon (CH) layer on top of the KCl. 1 refs., 8 figs.

46166 (LA-UR—88-1954) Computational simulations of the Laguna foil implosion experiments. Greene, A.E.; Bowers, R.L.; Brownell, J.H.; Oliphant, T.A.; Peterson, D.L.; Weiss, D.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880713—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014442/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Building on the results achieved in the Pioneer shot series, the Los Alamos foil implosion project is embarking on the Laguna foil implosion experiments. In this paper the system design is discussed and results from zero-, one-, and two-dimensional MHD preshot simulations are presented. The system will provide 5.5 MA to the 5-cm-radius, 2-cm-high, 250-nm-thick aluminum foil load. This should give rise to a 1.1 μs implosion with nearly 100 kJ of kinetic energy. 4 refs., 4 figs.

46167 (LBL—24949) Fatigue crack growth in metastable austenitic stainless steels. Mei, Z.; Chang, G.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 13p. (CONF-880653—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013709/JAW.

From International conference on cryogenic materials applications and properties; Shenyang, China (7 Jun 1988).

The research reported here is an investigation of the influence of the mechanically induced martensitic transformation on the fatigue crack growth rate in 304-type steels. The alloys 304L and 304LN were used to test the influence of composition, the testing temperatures 298 K and 77 K were used to study the influence of test temperature, and various load ratios (R) were used to determine the influence of the load ratio. It was found that decreasing the mechanical stability of the austenite by changing composition or lowering temperature decreases the fatigue crack growth rate. The R-ratio effect is more subtle. The fatigue crack growth rate increases with increasing R-ratio, even though this change increases the martensite transformation. Transformation-induced crack closure can explain the results in the threshold regime, but cannot explain the R-ratio effect at higher cyclic stress intensities. 26 refs., 6 figs.

46168 (LBL—25023) High-Mn steel weldment mechanical properties at 4 K. Chan, J.W.; Sunwoo, A.J.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 28p. (CONF-8804142—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013599/JAW.

From American Welding Society meeting; New Orleans, LA, USA (18 Apr 1988).

Advanced high-field superconducting magnets of the next generation of magnetic confinement fusion devices will require structural alloys with high yield strength and high toughness at cryogenic temperatures. Commercially available alloys used in the current generation of magnets, such as 300 series stainless steels, do not have the required properties. N-strengthened, high-Mn alloys meet base plate requirements in the as-rolled condition. However, the property changes associated with weld microstructural and chemical changes in these alloys have not been well characterized. In this work welding induced cryogenic mechanical property changes of an 18Mn-16Cr-5Ni-0.2N alloy are correlated with as-solidified weld microstructures and chemistries. 30 refs., 12 figs., 3 tabs.

46169 (MLM—3520(OP)) Measurement and prediction of tritium holdup. Ellefson, R.E.; Lindsay, C.N.; Johns, E.E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1988. Contract AC04-76DP00053. 5p. (CONF-880505—39). NTIS, PC A02. Order Number DE88012873/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

Total inventory of tritium requires quantitation of the residual tritium that remains in the process after a normal measurement of bulk gas inventory by PVT/Gas Analysis methods. Two process elements known to exhibit this holdup are uranium getter pumps (U-beds) and molecular sieve traps. Methods for measurement of holdup on these process elements are presented based on isotopic dilution (H or D). For the U-beds, a qualified method for prediction of holdup is presented based on the flow rate as a function of time for the evolved gas. The method is noninvasive, uses data from the normal inventory bakeoff and allows a shortened bakeoff period for inventory measurement. 6 refs., 2 figs., 2 tabs.

46170 (SAND—87-1957) A user manual for the collisional-radiative equilibrium code suite: SPECTRA. Dukart, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 63p. NTIS, PC A04. Order Number DE88012751/JAW.

A collisional-radiative equilibrium (CRE) model of H-, He-, and Li-like ions has been adapted to the Sandia VAX system. This user-friendly, interactive model can be used to determine electron temperatures and densities of plasmas from analysis of their characteristic H-, He-, and Li-like x-ray emission spectra. The model, obtained from R. W. Lee(LLNL), is called "SPECTRA" and consists of a suite of three codes: RATION, RATSHOW, and SPECTRA. RATION is a rate equation solver which produces a disk file containing atomic energy levels, level statistics, transition rates and level populations of all ionic stages of an atom for various plasma temperatures and densities. RATSHOW and SPECTRA then use

this file to determine the plasma electron temperature and density. RATSHOW generates plots of line ratios as a function of electron temperature and density. SPECTRS creates an artificial spectrum for a given set of plasma and instrumental parameters, which is then graphically compared with digitized data and adjusted until the proper plasma conditions are determined. RATSHOW and SPECTRA can also use an input file generated by other means, allowing, for instance, the use of temperature and density sensitivities of ions from other ionization stages (e.g. Li-like or Ne-like) for analysis. 16 figs.

46171 (UCLA/PPG—1163) Erosion and redeposition behavior of selected net-candidate materials under high-flux hydrogen, deuterium plasma bombardment in PISCES. Franconi, E.; Hirooka, Y.; Conn, R.W.; Leung, W.K.; LaBombard, B.; Nygren, R.E. (California Univ., Los Angeles (USA). Dept. of Mechanical, Aerospace and Nuclear Engineering). Jun 1988. Contract AS03-84ER52104. 18p. (CONF-880512—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013612/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

Plasma erosion and redeposition behavior of selected candidate materials for plasma-facing components in the NET-machine have been investigated using the PISCES-A facility. Materials studied include SiC-impregnated graphite, 2D graphite weaves with and without CVD- SiC coatings, and isotropic graphite. These specimens were exposed to continuous hydrogen or deuterium plasmas under the following conditions: electron temperature range from 5 to 35eV; plasma density range from 5 x 10^{11} to 1 x 10^{13} cm^{-3}; flux range from 5 x 10^{17} to 2 x 10^{18} ions cm^{-2} s^{-1}; fluence of the order from 10^{21} to 10^{23} ions/cm^2; bombarding energies of 50 and 100eV; target temperature range from 300 to 1000{degree}C. The erosion yield of SiC-impregnated graphite due to deuterium plasma bombardment is found to be a factor of 2 to 3 less than that of isotropic graphite materials. A further factor of 2-3 reduction in the erosion yield is observed in when redeposition associated with reionization of sputtered particle becomes significant. From post-bombardment surface analysis with AES, the surface composition in terms of the Si/C of SiC-impregnated graphite ratio is found to increase from 0.15 to 0.7 after hydrogen plasma bombardment to a fluence around 4 x 10^{21} ions/cm^2 at 350{degree}C. However, the final surface composition appears to remain unchanged up to 4 x 10^{23} ions/cm^2, the highest fluence in the present study. Significant surface morphological modifications of SiC-impregnated graphite are observed after the high-fluence plasma exposure. Several structural problems such as coating-substrate adhesion have been pointed out for SiC-coated 2D graphite weave. 11 refs., 6 figs., 1 tab.

46172 (UCLA/PPG—1167) An in-situ spectroscopic erosion yield measurement with applications to sputtering and surface morphology alterations. Leung, W.K.; Hirooka, Y.; Conn, R.W.; Goebel, D.M.; LaBombard, B.; Nygren, R. (California Univ., Los Angeles (USA). Dept. of Mechanical, Aerospace and Nuclear Engineering). Jul 1988. Contract AS03-84ER52104. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014085/JAW.

An in-situ spectroscopic erosion yield measurement is developed and used to monitor material surface erosion during bombardment by a plasma. The experiments are performed in a plasma that has the characteristics of a fusion tokamak boundary plasma but the technique is applicable to many processes where plasma erosion is important. Erosion yield of materials bombarded in a high flux (up to 10^{18}ion/cm^2/s) plasma environment has been previously studied using weight loss measurements. In the present study, the sputtered flux from a material is monitored by the line emission intensities of atoms eroded from the surface. The line intensities can be used to infer erosion yields after proper calibration. The method agrees well with results from weight loss measurements. Earlier work established that the material surface structure can substantially influence the erosion yield. When a change of surface morphology (e.g. cone formation) occurs, weight loss methods cannot be used to determine the erosion yield. However, the in-situ erosion measurement is suitable and is used to investigate the relation between the on-set of morphology changes and alternations in erosion yield during plasma bombardment. Experiments are reported for copper, as an example of pure material, and stainless steel, as a example of an alloy system. The formation of surface cones is observed only when both the sample temperature is above a critical value and surface impurities exist. If the source of impurities is removed, or the sample temperature is lowered below the critical values, a surface rough with cones will be returned to smooth state. 20 refs., 10 figs.

46173 Magnetron injection gun scaling. Lawson, W. (Lab. for Plasma and Fusion Energy Studies, Univ. of Maryland, College Park, MD (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 290-295(Apr 1988).

Existing analytic design equations for magnetron injection guns (MIG's) are approximated to obtain a set of scaling laws. The constraints are chosen to examine the maximum peak power capabilities of MIG's. The scaling laws are compared with exact solutions of the design equations and are supported by MIG simulations.

46174 Low-jitter laser-triggered vacuum switch using a composite target. Brannon, P.J.; Cowgill, D.F. (Sandia National Labs., Albuquerque, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 325-327(Apr 1988).

A laser-triggered high-voltage vacuum switch with a unique composite KCl/Ti target pellet has been developed. The switch triggers reliably for 532-nm laser input energies of 20 μJ corresponding to a peak irradiance of 1 MW/cm/sup 2/. Jitter times of less than +-15 ns and delay times of less than 100 ns are observed.

46175 U.S. heavy-ion fusion systems assessment project overview. Dudziak, D.J.; Saylor, W.W.; Herrmannsfeldt, W.B. (Univ. of California, Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM (US)). *Fusion Technology;* **13**: No. 2, 207-216(Feb 1988).

A multi-institutional study was conducted to evaluate the potential of heavy-ion induction Linacs as inertial confinement fusion (ICF) drivers. This Heavy-Ion Fusion Systems Assessment (HIFSA) study was a U.S. effort to evaluate a wide range of possible system configurations for electric power plants driven by induction Linacs, as opposed to the radio-frequency accelerators used in previous heavy-ion fusion (HIF) power plant conceptual designs. In contrast to these earlier studies, the HIFSA project specifically avoided concentrating on a point design. Rather, cost/performance models of the major systems in an HIF power plant were devised by the institutions with expertise in the applicable technologies (e.g., Lawrence Berkeley Laboratory for induction accelerators and beam transport/focus; McDonnell Douglas Astronautics Company for cost scaling and systems modeling/intergration). (Detailed descriptions of these systems and associated integration/trade-off studies appear in other papers in this special issue.) Some of the key results of the HIFSA study are summarized and their significance assessed. The cardinal conclusions of the study are twofold: (a) Conceptual HIF power plants have estimated cost-of-electricity (COE) values that, at 1 GW (electric), are roughly comparable to those from other ICF and magnetic fusion system studies; and (b) HIF technology is robust in that there exists a large parameter space region in which the COE is close to the minimum; i.e., the minima in COE are broad.

46176 An induction Linac driven heavy-ion fusion systems model. Zuckerman, D.S.; Driemeyer, D.E.; Waganer, L.M.; Dudziak, D.J. (McDonnell Douglas Astronautics Co., P.O. Box 516, St. Louis, MO (US)). *Fusion Technology;* **13**: No. 2, 217-254(Feb 1988).

A computerized systems model of a heavy-ion fusion (HIF) reactor power plant is presented. The model can be used to analyze the behavior and projected costs of a commercial power plant using an induction linear accelerator (Linac) as a driver. Each major component of the model (targets, reactor cavity, Linac, beam transport, power flow, balance of plant, and costing) is discussed. Various target, reactor cavity, Linac, and beam transport schemes are examined and compared. The preferred operating regime for such a power plant is also examined. The results show that HIF power plants can compete with other advanced energy concepts at

the 1000-MW(electric) power level [cost of electricity (COE) —50 mill/kW . h] provided that the cost savings predicted for Linacs using higher charge-state ions (+3) can be realized. The induction Linac driver is still a major component of the total capital cost (43%), but it no longer appears that large 4000-MW(electric), $5 billion (1984) power plants will be required to make the economics of HIF look favorable. More importantly, the results also indicate that there are several different combinations of target and reactor cavity options that lead to COEs within 10% of the overall minimum. The induction Linac's higher efficiency (>20%) is able to compensate for changes in target concept (gain) and cavity type with minimal change in COE. The potential cost reductions and apparent flexibility identified by this study together with the established performance data base from present-day accelerators are leading to renewed interest in induction Linacs for near-term target development applications.

46177 **Heavy-ion fusion systems assessment implications for reactors.** Pendergrass, J.H. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM (US)). *Fusion Technology;* 13: No. 2, 290-332(Feb 1988).

The requirements, desirable characteristics, trade-offs, and design constraints are discussed for commercial heavy-ion fusion (HIF) reactor plants with induction linear accelerator (Linac) drivers. The trade-offs and the design constraints when the reactor plant requirements and desirable characteristics conflict with those for other HIF power plant systems are described. The reactor plant concepts included in the Heavy-Ion Fusion Systems Assessment (HIFSA) are discussed in relation to these requirements, characteristics, trade-offs, and constraints. Four reactor plant concepts were included in the HIFSA studies to provide large ranges of reactor repetition rate and target yield accommodation (1 to 20 Hz and 150 to 3000 MJ). This permitted thorough exploration of the impact of HIF cost of electricity (COE) of the high repetition rate and efficiency advantages of induction Linacs. Contrary to pre-HIFSA expectations, large plants with large driver repetition rates and multiple reactors are not required for attractive COE: Repetition rates <10 Hz in 1000-MW(electric) one-reactor plants are competitive. More than one HIF reactor plant concept shows promise: The minimum COE estimates for the four concepts in 1000-MW(electric) plants range from 55 to 75 mill/kW . h. cost and/or technological problems in one part of reactor operating parameter space need not be fatal for HIF: The estimated COE is within 5% of the minimum over wide ranges of the repetition rate and the target yield for a fixed plant size and reactor concept.

46178 **Analysis of cavity gas conditions in heavy-ion beam fusion reactors.** Peterson, R.R. (Univ. of Wisconsin-Madison, Fusion Technology Institute, 1500 Johnson Drive, Madison, WI (US)). *Fusion Technology;* 13: No. 2, 279-289(Feb 1988).

The limits on the cavity gas density required for beam propagation and condensation times for material vaporized by target explosions can determine the maximum repetition rate of heavy-ion fusion (HIF) driven reactors. If the ions are ballistically focused onto the target, the cavity gas must have a density below roughly 3 X 10/sup 12/cm/sup -3/ at the time of propagation; other propagation schemes may allow densities as high as 1 Torr or more. In some reactor designs, several kilograms of material may be vaporized from the target chamber walls by target-generated X rays, raising the average density in the cavity to 3 X 10/sup 18/cm/sup -3/ or more. A one-dimensional combined radiation hydrodynamics and vaporization and condensation computer code has been used to simulate the vaporization and condensation of material in the target chambers of HIF reactors. Repetition rates in excess of 1 Hz are possible in the three types of target chambers studied. Means of increasing allowable repetition rates are discussed.

46179 **System studies of compact ignition tokamaks.** Galambos, J.D.; Blackfield, D.T.; Peng, Y.K.M.; Reid, R.L.; Strickler, D.J.; Selcow, E.C. (Oak Ridge National Lab., Fusion Engineering Design Center, Oak Ridge, TN (US)). *Fusion Technology;* 13: No. 1, 93-114(Jan 1988).

The new Tokamak Systems Code, used to investigate compact ignition tokamaks (CITs), can simultaneously vary many parameters, satisfy many constraints, and minimize or maximize a figure of merit. It is useful lin comparing different CIT design configurations over wide regions of parameter space and in determining a desired design point for more detailed physics and engineering analysis, as well as for performing sensitivity studies for physics or engineering issues. Operational windows in major radius (R) and toroidal field (B) for fixed ignition margin are calculated for the Ignifed and Inconel candidate CITs. The minimum R bounds are predominantly physics limited, and the maximum R portions of the windows are engineering limited. For a modified Kaye-Goldston plasma energy confinement scaling, the minimum size is 1.15 m for the Ignifed device and 1.25 m for the Inconel device. With the Ignition Technical Oversight Committee physics guidance of B/sup 2/a/q* and I/sub rho/ > 10 MA, the Ignifed and baseline Inconel devices have minimum sizes of 1.2 and 1.25 m and toroidal fields of 11 and 10.4 T, respectively. Sensitivity studies show Ignifed to be more sensitive to coil temperature changes than the Inconel device, whereas the Inconel device is more sensitive to stress perturbations.

46180 **Subcooled water flow boiling experiments under uniform high heat flux conditions.** Boyd, R.D. (Prairie View A and M Univ., Dept. of Mechanical Engineering, Prairie View, TX (US)). *Fusion Technology;* 13: No. 1, 131-142(Jan 1988).

This work involves steady-state high heat flux removal in fusion reactor beam dumps, first walls in compact fusion reactors, and other applications with smooth surfaces and/or irregular coolant channel cross sections. In such applications, the coolant pressure is required to be low ({approx} 1.0 MPa), and the coolant channels are moderately long [length-to-diameter ratio (L/D) {approx} 100]. The present experiments have resulted in high heat flux data in a region where only sparse data existed. Subcooled flow boiling measurements were performed for the critical heat flux (CHF), local (axial) variations of the coolant channel's heat transfer coefficients, and pressure drop for horizontal, uniformly heated tubes. The tubes had inside diameters of 0.3 cm, a heated L/D ratio of 96.6, and were made of amzirc (zirconium-copper). The coolant was degassed, deionized water. The exit pressure and the inlet water temperature were held approximately constant at 0.77 MPa and 20{sup 0}C, respectively. From experiment to experiment, the inlet temperature varied slightly (+- 1.5{sup 0}C) from 20{sup 0}C. The actual measured inlet temperature was used in reducing the experimental data. Measurements of the above quantities were performed for the mass velocity and exit subcooling, varying from 4.6 to 40.6 Mg/m/sup 2/ . s and 30 to 74{sup 0}C, respectively. For these ranges, (a) the subcooled flow boiling CHF varied from 625 to 4158 W/cm/sup 2/, (b) the heat transfer coefficients during fully developed nucleate boiling varied from 30 to 400 kW/m/sup 2/ . K (Nusselt number = 150 to 1700), and (c) the overall pressure drop varied from -- 1.75 to 0.9 times the adiabatic pressure drop. For the flow conditions and geometry parameters given above, least-squares equations for the CHF were developed in terms of both the liquid Reynolds number and the exit subcooling. The average percent deviation of the developed equations from the data was <12.5%.

46181 **Modular pump limiter systems for large tokamaks.** Uckan, T.; Klepper, C.C.; Mioduszewski, P.K. (Oak Ridge National Lab., Fusion Energy Div., Oak Ridge, TN (US)). *Fusion Technology;* 13: No. 1, 165-180(Jan 1988).

Long-pulse (>10-s) operation of large tokamaks with high-power (>10-MW) heating and extensive external fueling will require correspondingly efficient particle exhaust for density control. A pump limiter can provide the needed exhaust capability by removing a small percentage of the particles, which would otherwise be recycled. Single pump limiter modules have been operated successfully on the Impurity Study Experiment-B, the Poloidal Divertor Experiment, TEXTOR, and the Princeton Large Torus. An axisymmetric pump limiter is now being installed and will be studied in TEXTOR. A third type of pump limiter is a system that consists of several modules and exhibits performance different from that of a single module. To take advantage of the flexibility of a modular pump limiter system in a high-power, long-pulse device, the power load must be distributed among a number of modules. Because each added module changes the performance of all the others, a set of design criteria must be defined for the overall limiter system. The design parameters for the modules are then determined from the

system requirements for particle and power removal. Design criteria and parameters are presented, and the impact on module design of the state of the art in engineering technology is discussed. The relationships between modules are considered from the standpoint of flux coverage and shadowing effects. The results are applied to the Tore Supra tokamak. A preliminary conceptual design for the Tore Supra pump limiter system is discussed, and the design parameters of the limiter modules are presented.

46182 Thermal analysis of the forced cooled conductor for the TF superconducting coils in the TIBER II ETR Design. Kerns, J.A.; Slack, D.S.; Miller, J.R. (Lawrence Livermore National Lab., CA (USA)). pp 175-182 of Advances in cryogenic engineering. Volume 33. Fast, R.W. (ed.). New York, NY; Plenum Press (1988). (CONF-8706125—). Contract W-7405-ENG-48.

From Cryogenic engineering conference; St. Charles, IL, USA (14 Jun 1987).

The baseline design for TIBER II is to provide steady-state nuclear burn capabilities. The design is constrained to be cost effective and must therefore be sized as small as possible. This constraint limits the nuclear shielding in TIBER and dictates a nuclear heat load of up to 4.5 kW per coil for the toroidal field coils. The cooling scenario and thermal analysis for this design are presented.

46183 ICH antenna development on the ORNL RF test facility. Gardner, W.L.; Bigelow, T.S.; Haste, G.R.; Hoffman, D.J.; Livesey, R.L. (Oak Ridge National Laboratory, Oak Ridge, TN 37831). *AIP (American Institute of Physics) Conference Proceedings;* **159**: No. 1, 306-309(Sep 1987). (CONF-870570—).

From 7. topical conference on applications of radio-frequency power to plasmas; Kissimmee, FL, USA (4 May 1987).

A compact resonant loop antenna is installed on the ORNL Radio Frequency Test Facility (RFTF). Facility characteristics include a steady-state magnetic field of ≅0.5 T at the antenna, microwave-generated plasmas with n/sub e/≅10^{13} cm^{-3} and T/sub e/≅8 eV, and 100 kW of 25-MHz rf power. The antenna is tunable from ~22—75 MHz, is designed to handle ≧1 MW of rf power, and can be moved 5 cm with respect to the port flange. Antenna characteristics reported and discussed include the effect of magnetic field on rf voltage breakdown at the capacitor, the effects of magnetic field and plasma on rf voltage breakdown between the radiating element and the Faraday shield, the effects of graphite on Faraday shield losses, and the efficiency of coupling to the plasma.

99 GENERAL AND MISCELLANEOUS

46184 (SAAS—357) Report of the National Board of Nuclear Safety and Radiation Protection of the GDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. Vp. (GE;EN). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

Individual papers are processed separately.

9901 Management

REFER ALSO TO CITATION(S) 45063

46185 (OUP—88-05) Section for nuclear physics annual report. January 1 - December 31, 1987. (Oslo Univ. (Norway). Fysisk Inst.). Apr 1988. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754484/JAW.

The experimental activities have in 1987, as in the previous years, mainly been centered around the cyclotron laboratory with the SCANDITRONIX MC-35 cyclotron. Most of the nuclear physics experiments have been related to the study of nuclear structure at high temperature. Theoretical studies of highly excited nuclei have continued, and there has been a fruitful cooperation between experimental and theoretical physicists.

46186 (SAAS—357, pp 54-62) Governmental control of atomic safety and radiation protection in the German Democratic Republic. Richter, D. 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

In 1962 the government of the GDR established a National Board for Atomic Safety and Radiation Protection (SAAS) as the responsible regulatory body for the control of the safe use of atomic energy. Its protection goals cover radiation protection, nuclear facility safety, nuclear environmental protection, nuclear material safeguards and physical protection. The SAAS functions include the setting of regulations; licensing; surveillance of the radiation exposure to man, the safety of the facilities and the environmental radioactivity; and the training of experts. More than 7000 licenses have been issued so far for a great variety of atomic energy applications, and more than 40,000 radiation workers as well as the whole GDR territory are monitored regularly.

46187 (SAAS—357, pp 63-71) Education and training - prerequisites for the safe use of nuclear energy. Steuer, J.; Rehak, W. 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780091/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

The system of training measures for persons engaged in the application of atomic energy in the German Democratic Republic is described. Sufficient qualification is a precondition for granting the state licence necessary for work with nuclear energy and application of ionizing radiation sources. Training of graduates, technicians and workers in nuclear power plants, hospitals, enterprises and others is described in detail. It includes college and university studies as well as courses on the application of radiation sources. In the fields of atomic safety and radiation protection the National Board for Atomic Safety and Radiation Protection exercises the function of a national training centre.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 45535

46188 (AD-A—192295/4/XAB) Comparing alternative computer-based methods for presenting job-task instructions. Interim report, May 1986-May 1987. Nugent, W.A. (Navy Personnel Research and Development Center, San Diego, CA (USA)). Feb 1988. 77p. (NPRDC-TR—88-6). NTIS, PC A05/MF A01.

This study compared the effects of previous task training/experience and alternative methods for presenting procedural instructions on job-task performance. Six computer-based methods were examined by having oscilloscope operators perform four equipment-related tasks. The presentation methods were text-only, audio-only, text-audio, text-graphics, audio-training and experience in operating oscilloscopes. The most-efficient and effective task performances were obtained through a combination of audio and graphic presentations, an effect which can be further enhanced by the addition of redundant textual instructions. The practical applications and theoretical implications of these findings are discussed.

46189 (AD-A—192321/8/XAB) Parallel solutions to geometric problems on the scan model of computation. Memorandum report. Blelloch, G.E.; Little, J.J. (Massachusetts Inst. of Tech., Cambridge (USA). Artificial Intelligence Lab.). Feb 1988. 34p. (AI-M—952). NTIS, PC A03/MF A01.

This paper describes several parallel algorithms that solve geometric problems. The algorithms are based on a vector model of computation - the scanmodel. The purpose of this paper is both to show how the model can be used and to show a set of interesting algorithms. A k-D tree algorithm is described that, for n points, requires O(lg n) calls to the primitives, a closets-pair algorithm that requires O(lg n) calls to the primitives, a line-drawing algorithm that requires O(1) calls to the primitives, a line-of-sight algorithm that requires O(1) calls to the primitives, and finally three different convex-hull algorithms. All these algorithms should be noted for their simplicity rather than complexity; many of them are parallel

versions of known serial algorithms. Most of the algorithms discussed have been implemented on the Connection Machine, a highly parallel single-instruction multiple data (SIMD) computer.

46190 **(AD-A—192387/9/XAB) Force user's manual (revision). Interim report.** Jordan, H.F.; Benten, M.S.; Ramanan, A.V.; Arenstorf, N.S. (Colorado Univ., Boulder (USA). Computer Systems Design Group). Oct 1987. 33p. (CSDG—87-2-REV). NTIS, PC A03/MF A01.

A methodology for writing parallel programs for shared-memory multiprocessors was formalized as an extension to the Fortran language and implemented as a macro preprocessor. The extended language is known as the Force, and this manual describes how to write Force programs and execute them on the Flexible Computer Corporation Flex/32, the Encore Multimax and the Sequent Balance computers. The parallel extension macros are described in detail, but knowledge of Fortran is assumed.

46191 **(AD-A—192553/6/XAB) Automated Crystal Runtime system: a framework.** Saltz, J.H.; Mirchandaney, R.; Smith, R.M.; Nicol, D.M.; Crowley, K. (Yale Univ., New Haven, CT (USA). Dept. of Computer Science). Jan 1988. 27p. (YALEU/DCS/TR—588). NTIS, PC A03/MF A01.

There exists substantial data-level parallelism in scientific problems. The Crystal/ACRE(Automated Crystal Runtime Environment) runtime system is an attempt to obtain parallel, implementations for scientific computations, particularly those where the data dependencies are manifest only at runtime. This can preclude compiler-based detection of certain types of parallelism. The automated system is structured as follows: An appropriate level of granularity is first selected for the computations. A directed acyclic-graph representation of the program is generated on which various aggregation techniques may be employed in order to generate efficient schedules. These schedules are then mapped onto the largest machine. We describe some initial results from experiments conducted on the Intel Hypercube and the Encore Multimax that indicate the usefulness of the approach. Using the runtime system, it will be relatively easy to program different applications and study the performance implications of the various parameters. When the performance data are available, mathematical models that describe the relationships between the various important parameters in the system can be developed.

46192 **(AD-A—192725/0/XAB) Bisimulation can't be traced. Preliminary report.** Bloom, B.; Istrail, S.; Meyer, A.R. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Computer Science). Nov 1987. 24p. (MIT/LCS/TM—345). NTIS, PC A03/MF A01.

Bisimulation is the primitive notion of equivalence between concurrent processes in Milner's Calculus of Communicating Systems (CCS); there is a nontrivial game-like protocol for distinguishing nonbisimular processes. In contrast, process distinguishability in Hoare's theory of Communicating Sequential processes (CSP) is determined soley on the basis of traces of visible actions. The authors examine what additional operations are needed to explain bisimulation similarly-specifically in the case of finitely branching processes without silent moves. They formulate a general notion of Structured Operational Semantics for processes with Guarded recursion (GSOS), and demonstrate that bisimulation does not agree with trace congruence with respect to any set of GSOS-definable contexts. In justifying the generality and significance of GSOS's, some of the basic proof theoretic facts are worked out that justify the SOS discipline.

46193 **(AD-A—192833/2/XAB) Image processing using a parallel architecture. Master's thesis.** Hodges, B.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1987. 119p. (AFIT/GE/ENG—87D-25). NTIS, PC A06/MF A01.

This study developed a set of low-level image processing on a parallel computer that allows concurrent processing of images in order to support development of systems that use multiple images to gather information. The parallel computer used is a collection of powerful processors connected in a hypercube topology. The software developed simplifies the interface between the parallel computer and the applications developer by providing a library of functions in the C programming language. These functions are used to control image processor programs that run independently in the parallel computer and perform the image-processing operations. The complexities of the parallel processor are hidden and replaced with a flexible structure specifically designed for image processing. This structure provides a simplified interface, but also acts as a framework to which additional image-processing operations can be added.

46194 **(AD-A—192915/7/XAB) Research in VLSI computer systems. Progress report, April-October 1987.** Hennessy, J. (Stanford Univ., CA (USA). Computer Systems Lab.). Oct 1987. 17p. NTIS, PC A03/MF A01.

This report summarizes progress in the DARPA-funded projects in the areas of multiprocessor architecture and software, and computer-aided design from April to October 1987. The major areas under investigation include: analysis and synthesis design aids, high performance chip design, multiprocessors, and VLSI computer architectures. The major research problems are introduced and progress is discussed; the Appendix contains a list of published research papers from these projects.

46195 **(CMI-R—30850-1) Facet generation and relaxation technique applied to an assignment problem with side constraints.** Aboudi, R.: Hallefjord, Aa.; Joernsten, K. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Jan 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753685/JAW.

We consider a solution method for combinatorial optimization problems based on the combination of Lagrangian relaxation and constraint generation techniques. The procedure is applied to a constrained assignment problem, where subsets of variables are specified, and variables belonging to the same subset must have the same value. The model can be applied to solve constrained job and classroom assignment problems. The procedure we suggest requires only the solution of classical assignment subproblem. An illustrative numerical example is given. 9 refs.

46196 **(CONF-880856—1) Models for parallel computation on distributed-memory multiprocessors.** King, Chung-Ta; Ni, L.M. (Michigan State Univ., East Lansing (USA); Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010078/JAW.

From International conference on parallel processing; University Park, PA, USA (15 Aug 1988).

The most severe shortcoming of distributed-memory multiprocessors is the communication overhead. Due to the distributed nature of such systems, data must be moved explicit among the processors, including the host, so as to carry out a computing job. Efficient algorithm design becomes crucial in fully utilizing the computing power of the multiprocessors. In this paper a model for parallel computation is proposed, which views a computation as consisting of a hierarchy of multiple logical pipelines. The multiprocessor is organized as pipelines to perform the computation, which takes advantage of overlapped communication and computation in the pipelines to reduce the communication overhead in the system. An analytic model is introduced to characterize the effects of partitioning and pipelining on the resulting performance. Through such analyses, important design parameters can be determined and efficient algorithms will result. Three examples are discussed to illustrate the application of the models. Performance analysis through the analytic model shows an almost linear speedup using overlapped and pipelined operations. 16 refs., 13 figs., 1 tab.

46197 **(CONF-880859—1) Practical issues relating to the internal database predicates in an OR-parallel Prolog: Extensions and useful hacks.** Carlsson, M.; Danhof, K.; Overbeek, R. (Swedish Inst. of Computer Science; Southern Illinois Univ., Carbondale (USA); Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010019/JAW.

From 5. international logic programming conference; Seattle, WA, USA (15 Aug 1988).

This technical report is being written to document and explain some of the insights the authors have gained during the implementation of two OR-parallel Prolog systems for shared-memory multiprocessors. We have been quite amazed by how much power and functionality can be achieved through the implementation of just a few primitive predicates. We introduce a few relatively trival predicates which allow one to implement versions of findall/3, bagof/3, and setof/3 for the multiprocessors environment. Then we show how these predicates can be used to implement AND-parallelism. Finally, we illustrate their use for implementing a limited notion of streams, and how such streams can be used to create a compiler that achieves excellent speedups for multiprocessors with a limited number of processors. 5 refs.

46198 **(CONF-880872—3) Some properties of a moment estimator for the index parameter of negative binomial distribution.** Lam, H.K.; Shenton, L.R.; Bowman, K.O. (Bell Communications Research, Inc., Red Bank, NJ (USA); Georgia Univ., Athens (USA); Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011436/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

Taking the mean of the negative binomial to be kP and the variance kP(1+p), a moment estimator of k is $(m_1')^2/(m_2-m_1')$. From previous studies it is known that the series development for the moments of the momentor estimator k* appear to be markedly divergent (probably due to singularity in the denominator). The present study shows that the moments of 1/k* are more stable than those of k*. Thus, if we wish to make inference about k by using 4-moment distribution fitting, then the moments of 1/k* should be used, rather than those of k*. 2 refs., 2 tabs.

46199 **(DOE/EIA—M030) Short-Term Integrated Forecasting System: 1988 model documentation report.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 1988. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014711/JAW.

This report is written for persons who want to know how integrated short-term forecasts are produced by EIA. The demand forecasts for petroleum, electricity, coal, and natural gas are described in the first section of this report, followed by a section on petroleum and natural gas supply, and ending with a description of the integrating model. This report has been written to comply with the requirements specified in EIA Order EI 5910-.3B. "Guidelines and Procedures for Model Documentation," effective October 1, 1985. The requirement for a corresponding model archival package is met by the creation of the CN6777.PRJ.STIFS188 archive tape, which contains all the files needed to replicate the forecasts published in the January 1988 Outlook. Instructions for loading and executing these files are contained in the last file (46) on the archive tape, CN6777.PRJ.STIFS188.INSTALL.MANUAL. 28 refs., 5 figs., 57 tabs.

46200 **(EPRI-EL—5889-Vol.1) Evaluation of software development tools: Volume 1, Project overview: Final report.** Klein, S.A.; Beardmore, J.A. (Electric Power Research Inst., Palo Alto, CA (USA); ORI, Inc., Rockville, MD (USA)). Jun 1988. 187p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012903/JAW.

This report presents the results of an evaluation of software development and maintenance tools for power system planning and operations software. The objectives of the project were to determine the usefulness of currently available software development tools, to determine the requirements for software tools that are not currently available, and to make recommendations on the appropriate role for EPRI in tool usage and future tool development. 5 figs., 23 tabs.

46201 **(INIS-mf—11224) Feasibility study of the vectorization of nuclear codes used at the ENEL Thermal and Nuclear Research Centre. Report 407.** Di Pasquantonio, F. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). 1987. 289p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88702875/JAW.

The purpose of this report is that of analyzing tha problems connected with the vectorization and/or multitasking of several computer codes utilized in the ENEL-DSR Centro Ricerca Termica e Nucleare. After some general remarks on vector computers the analysis is focused on some topic relating to vectorization and multitasking of programs written for scalar computers. The priority for vectorization and/or multitasking has been given at the following codes: 1) DOT 4.2 (radiation transport and shielding); 2) QUANDRY (accidental and operating transients in LWR cores); 3) MORSE and MCNP (Monte Carlo codes for radiation transport and shielding); 4) RELAP (accidental and operating transients in LWR plants); 5) TRAP-MELT and NAUA (evaluation of source term). The principal results of the study are the following: 1) For the DOT 4.2 code it is convenients to improve the vectorized version DOT IV/C developed by Swanson introducing the parallel S.O.R. iterative method; 2) For the code QUANDRY it is proposed to introduce the three dimensional red-black mesh point ordering named "diagonal method"; 3) To implements, on the CRAY X/MP 48, the multitasked version of the code MCNP developed by the Los Alamos National Lboratory; 4) To implements, on the CRAY X/MP 12, the vectorized and optimized version of the codes RELAP5/MOD1-MOD2 developed by J.R.C. EUROATOM-Ispra; 5) For the codes TRAP-MELT and NAUA the insertion of the vectorized routines LSODP na LSODPK for dominanting stiff cases. 89 refs.

46202 **(ITEF—70(1987)) Network software of FD-NET local network for the RT-11 operational system.** Bobyshev, A.N.; Kutsenko, V.A.; Kravtsov, A.I.; Korzhavin, A.I.; Rozhkov, A.B.; Semenov, Yu.A.; Fedotov, O.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88702886/JAW.

Description of software of FD-Net ring local network based on the "Elektronika-60" and "MERA-60" microcomputers as well as on SM-3, SM-4 and "MERA-125" minicomputers is given. FD-Net local network is aimed at automatization of complex and labour-consuming physical experiments carried out at the THEP. It permits to carry out simultaneous application of external devices, files and programs as well as data exchange between problems solved by different computers. The architecture of FD-Net network hardware is considered as well as a general structure of software. Certain modules of network software and their interaction with each other are described. 4 refs.; 2 figs.

46203 **(JINR—R-11-87-427) Optimization of the two-dimensional magnetic field distribution basing on the integral equation method.** Akishin, P.G.; Zhidkov, E.P.; Kravtsov, V.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702940/JAW.

The problem of optimization of the two-dimensional magnetic field distribution is considered. The integral equation method is used for solving the direct problem. The task is reduced to the minimization of a functional which defines the quality of magnetic field distribution. The code realizing this method is created. The results of numerical experiments are discussed. 6 refs.; 4 figs.

46204 **(JINR—R-11-87-473) Adaptive generator of random numbers (SMART).** Takhtamyshev, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88702943/JAW.

A program, which can be used as a random number generator in Monte Carlo calculations is described. On the first stage of calculation the program is collecting information on probability density function density function (weighting or integrable func-

tions). This information is used hereupon in order to produce more random points near maximum of the function. Test results demonstrate that the essential gain in convergency speed an be achieved with this generator. 3 figs.

46205 **(K/CSD/TM—64-Rev.2) Phase 3 automated estimating system (AES): Version 3.0, User's manual.** Holder, D.A.; Schwarz, R.L. (ed.). (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jun 1988. Contract AC05-84OR21400. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88013327/JAW.

This document describes Version 3.0 of the Automated Estimating System, a personal computer-based software package designed to aid in the creation, updating, and reporting of project cost Estimating and Scheduling Department of the Martin Marietta Systems Engineering Division.

46206 **(M—154-Rev.1) Fibre: An external format for Sisal and IF1 data objects, Version 1.1.** Skedzielewski, S.; Yates, R.K. (Lawrence Livermore National Lab., CA (USA)). 4 Apr 1988. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013804/JAW.

This manual describes an external representation of data for Sisal and IF1 programs. Fibre is intended as a notation for exchange of data for Sisal and IF1 benchmarks, and for the use in the development of Sisal to IF1 compilers. It is not intended as the only means of input and output; we hope that more powerful formatting functions will be provided for the Sisal applications programmers.

46207 **(NUREG/CR—4639-Vol.4-Pt.2) Nuclear computerized library for assessing reactor reliability (NUCLARR): Part 2, Guide to operations: User's guide.** Gilmore, W.E.; Gentillon, C.D.; Gertman, D.I.; Beers, G.H.; Galyean, W.J.; Gilbert, B.G. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 114p. (EGG—2458-Vol.4-Pt.2). NTIS, PC A06/MF A01 - GPO. Order Number TI88013644/JAW.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities. The NUCLARR system is documented in a five-volume series of reports. Volume IV of this series is the User's Guide for operating the NUCLARR software and is presented in three parts. This volume, Part 2: Guide to Operations, contains the instructions and basic procedures for using the NUCLARR software. Part 2 provides guidance and information for getting started, performing the desired functions, and making the most efficient use of the system's features.

46208 **(ORNL/DSRD—9) Cooperative processing feasibility for SNAP-II [Shipboard Nontactical ADP Program II].** Halsey, P.J.; Duncan, L.D.; Huntley, A.F.; Munro, J.K.; Twitty, A.F. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013346/JAW.

The Navy Management Systems Support Office (NAVMSSO) would like to improve the performance and transportability of the Harris/Shipboard Nontactical Automated Data Processing (ADP) Program II (SNAP-II) system and other NAVMASSO produced applications. The use of a technique called cooperative processing (microcomputer-to-mainframe connection package) was suggested as a way to achieve this improvement. NAVMSSO asked the Data Systems Engineering Organization (DSEO) to perform a feasibility study to determine the benefits cooperative processing would provide. An intensive review of the methodology and technology utilized in cooperative processing was performed. The SNAP-II application code was analyzed to determine the effort that would be involved in conversion from the existing SNAP-II host-bound environment to the PC/host cooperative processing environment. The DSEO team found that, due to the architecture of the SNAP-II subsystems, cooperative processing would not be a viable alternative to enhance system performance. The DSEO team determined that, before performance enhancement techniques could be selected, a comprehensive evaluation of the problems being experienced by the Harris system/SNAP-II application would be necessary.

46209 **(PB—88-185939/XAB) Extensible networks. Part 1: principles and constructions.** Peper, F. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1987. 20p. (REPT—87-91). NTIS, PC E03/MF A01.

This paper describes a construction method for networks that maintain their properties upon extension, such as a highly regular structure, fixed degree, high connectivity, and low diameter. Optimal routing functions for these networks appear to be invariant under extension. Finally, the method is used to construct an infinite class of extensible networks satisfying the above requirements.

46210 **(SAND—87-2034) Sandia National Laboratories flight simulation facilities.** Criel, T.M.; Wyatt, F.V. (Sandia National Labs., Albuquerque, NM (USA)). May 1988. Contract AC04-76DP00789. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012108/JAW.

Flight simulation computer facilities and motion simulator facilities at Sandia National Laboratories include an AD-100 (both real-time digital simulation computers), two AD-5s (analog computers), a VAX 11/780 (a digital mainframe), a PDP 11/60 (a digital computer), and a Carco S-450R-3/R three-axis motion simulator. This report describes the current equipment. 10 figs., 1 tab.

46211 **(WHC-SA—0005) A nuclear facility Security Analyzer written in PROLOG.** Zimmerman, B.D. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1987. Contract AC06-87RL10930. 9p. (CONF-870832—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013663/JAW.

From Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry; Snowbird, UT, USA (31 Aug 1987).

The Security Analyzer project was undertaken to use the Prolog "artificial intelligence" programming language and Entity-Relationship database construction techniques to produce an intelligent database computer program capable of analyzing the effectiveness of a nuclear facility's security systems. The Security Analyzer program can search through a facility to find all possible surreptitious entry paths that meet various user-selected time and detection probability criteria. The program can also respond to user-formulated queries concerning the database information. The intelligent database approach allows the program to perform a more comprehensive path search than other programs that only find a single "optimal" path. The program also is more flexible in that the database, once constructed, can be interrogated and used for purposes independent of the searching function.

46212 **VACATION: A microcomputer based scheduling tool.** Das, S.; Whitaker, R.A. (Energy and Economic Analysis Section, Energy Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 1723-1728 of Modeling and simulation. Volume 18, part 1: Economics, geography and regional science. Research Triangle Park, NC; Instrument Society of America (1987). (CONF-8704114—).

From 18. annual Pittsburgh conference on modeling and simulation; Pittsburgh, PA, USA (24 Apr 1987).

VACATION is a microcomputer based vacation scheduling tool where the scheduling concept is based on seniority of employee, while maintaining the minimum requirements of each craft category for each work location. Employee inputs to this decision process are his priorities on the different blocks of vacation days and his choice of dates for each of those priorities. The seniority concept is used on a priority basis only, so that the senior-most person does not get all his priorities at the very outset of the scheduling process. Each employee receives the vacation dates specified

at a given priority level before the scheduling of vacation is continued for the next priority based on seniority for all the employees. VACATION generates three different types of reports for each day of the calendar year (i.e. CALENDAR, STATUS, and SURPLUS) to aid management in relocating employees in case of a shortage of skills. VACATION is a user-friendly, interactive and menu-driven vacation scheduling took, written in PASCAL programming language it runs on an IBM-PC, or its compatibles, with minimum memory requirements of 256K. VACATION has been implemented in a work environment of 42 employees, 3 craft categories and 13 different work locations.

9903 Information Handling

REFER ALSO TO CITATION(S) 44797, 44831, 45001, 45077, 45078, 45884, 46207

46213 (AD-A—192373/9/XAB) Editfont - an interactive font-editing system. Master's thesis. Olivera, H.J.; Wu, C.T.; Zyda, M.J. (Naval Postgraduate School, Monterey, CA (USA)). Jan 1988. 62p. (NPS—52-88-001). NTIS, PC A04/MF A01.

The major goal of this work was the development and implementation of an interactive bit-mapped font editor that enables the graphics programmer to create different fonts and icons for use in application programs. The font editor, called Editfont, was implemented on the Silicon Graphics, Inc. IRIS work station. Editfont consists of approximately 3500 lines of code, including the program documentation. Fonts created by Editfont can be retrieved from disk and high-level routines implemented with the IRIS graphics library. One feature of the system is the capacity for font extraction from a picture. The steps for font generation via font extraction are explained in detail. File formats, data structures and routines used by the system are also described. Software and hardware limitations of the system are outlined, as well as possible future extensions.

46214 (AD-A—192779/7/XAB) Optical bus extenders for high-speed computers. Sawchuk, A.A. (Optivision, Inc., Davis, CA (USA)). 10 Feb 1988. 3p. NTIS, PC A02/MF A01.

A bus extender is a means for high-speed interconnection of a multitude of individual computing modules comprising a distributed computing system. When the elements to be interconnected are spaced by distances of more than a very few meters, there are significant advantages to the use of optics for providing the interconnects. The feasibility is being examined of using optical bus extenders in a strategic defense system. The advantages and limitations of both free-space communication and fiber communication over short distances are being determined. Critical issues are the bulk and cost of components, and the efficiency with which light can be detected at the end of the various links. Optimization of certain parameters of the extender are being explored with respect to both cost and performance. The general results obtained are being applied to the special case of the VME bus. Protocols to control activity on the extender are being considered and a preferred solution is being proposed. As issues arise that can be resolved only by breadboarding a collection of components or a small subsystem, then such breadboarding is being undertaken. The problem of simultaneously mapping the state of the bus to several remote locations is being examined. Various methods for tapping the optical energy for multiple destinations are being considered and the optical efficiency and cost of these solutions are being determined.

46215 (LBL—24894) A framework for expressing and controlling impressions in databases. Srivastava, J.; Rotem, D. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014036/JAW.

There are many database applications in which substantial reduction in the costs of data management and query processing may be achieved if some imprecision in the stored data is allowed. In such applications, a precision requirement may be assigned to a query which implies that the error in the answer should not exceed some predetermined bound. The degree of imprecision in the database must be controlled such that a query always operates on data which is sufficiently accurate such that the computed answer meets or exceeds the precision requirements of the query. In this paper, the concept of precision in databases for both queries and data is introduced and formalized. Algorithms for maintaining a database at a specified degree of precision are presented and analyzed. We then describe how these algorithms may be employed for the purpose of choosing an optimal query plan by a query optimizer. 23 refs., 5 figs., 5 tabs.

46216 (SI-R—860110-2) Information system to handle emergency situations and accidents. Augland, D.; Hustoft, A.G. (Senter for Industriforskning, Oslo (Norway)). Nov 1987. 42p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753718/JAW.

A description is given of a data system to handle emergency situations and accidents, especially offshore. The system is to collect, produce and disseminate relevant information, which makes it suitable as decision support. The system will be easy to use, and will be possible to connect to a users already existing equipment. A demonstration system has been developed, which shows the most important properties of such a system. 11 figs.

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REFER ALSO TO CITATION(S) 45940

46217 (AD-A—192404/2/XAB) Who is going to shoot down the first ICBM (intercontinental ballistic missiles) - man or machine. Student report. Piepenbrink, J.O. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 23p. (ACSC—88-2130). NTIS, PC A03/MF A01.

The short time available to attack ballistic missiles with a Strategic Defense Initiative (SDI) weapon system will preclude traditional national-level decision making. A unique command and control (C2) concept is required to best serve the balance between effectiveness and weapon system safety. This article develops that concept with a blend of autonomous operation with man in the loop and advocates early resolution to ensure C2 strategy and tactics push technology development.

46218 (AD-A—192416/6/XAB) United States military posture for FY 1989. (Joint Chiefs of Staff, Washington, DC (USA)). 1989. 115p. NTIS, PC A06/MF A01.

Original contains color plates: All DTIC/NTIS reproductions will be in black and white.

The primary purpose of this statement on the military posture of the United States is to supplement testimony by the Chairman and other members of the Joint Chiefs of Staff at congressional hearings in support of the FY 1989 Defense Budget. Chapter I is an overview that describes the main challenges to US national security, outlines objectives and elements of US military strategy, and highlights continuing efforts to field the best possible armed forces for the protection of US national interests. Chapter II compares US defense requirements and resource commitment with those of the Soviet Union. Chapter III provides an overview of the global military environment by comparing US and allied forces with Soviet and Warsaw Pact forces. Chapter IV assesses the current and projected capability of the US Armed Forces to meet the Soviet nuclear threat. Chapter V assesses the current and projected capability of the US Armed Forces, in concert with friends and allies, to meet the Soviet conventional military threat. This chapter deals primarily with joint perspectives that have increased the capabilities and efficiency of our forces. Chapter VI addresses other topics of interest. Unless otherwise noted, data shown in this report have used operational as opposed to treaty inventories for strategic weapon systems, a fiscal year cutoff date of 30 September 1987, and mobilized forces. Additionally, data have been developed based on a global as opposed to regional war scenario.

46219 (AD-A—192612/0/XAB) Joint chemical defense for the rear battle: main operating bases in NATO's central region. Student report. Salmi, M.D. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 46p. (ACSC—88-2305). NTIS, PC A03/MF A01.

In 1984, the Chiefs of Staff of the US Army and the US Air Force signed a Memorandum of Understanding (MOU) outlining a concept for the joint air defense of overseas air bases. With little previous experience in joint rear-area operations, problems were bound to occur, especially in the area of chemical warfare defense (CWD). The Army bases its CWD doctrine on the concept of maneuver while the Air Force bases its doctrine on being tied to air bases with little or no capability to avoid chemical attacks. Each Service developed its doctrine to support its operational concept. This study compared and contrasted the CWD doctrine of the Army and the Air Force. If found a great deal of commonality exists; however, there are also several problems which could lead to death, injury, and degradation of sortie generation capability.